RESPONSE OF ESSENTIAL HYPERTENSION AND DIABETES MELLITUS TO SMALL DOSES OF X-RAY *

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X-ray treatment of diabetes mellitus and essential hypertension or of the two conditions existing coincidentally in the same patient is based on the theory that these syndromes are due to some functional abnormality probably in the nature of hyperfunction of the pituitary or adrenals or both, and that the x-ray can be used to correct this abnormality. Evidence supporting this theory is voluminous and comes from the field of clinical medicine and the laboratories of pathology and experimental physiology. It has already been summarized elsewhere[1] and will not be repeated here. It should be pointed out, however, that all known hyperfunctioning states of the pituitary and adrenals are associated with hypertension or hyperglycemia or both and that, on the other hand, hypofunctioning conditions of these two organs are associated with low blood pressure, low blood sugar and an increased glucose tolerance. The interrelations of the pituitary and the adrenals are such that it is impossible now to differentiate clinical manifestations that may be due to one or the other.

There is some question as to whether this theory regarding the etiology of these two conditions is entirely complete or correct. However this may be, certain interesting clinical phenomena have been observed following this therapy, and improvement occurs in such a considerable number of cases that we are now more interested in determining the optimum dosage that will produce these favorable results than in devising or defending theories.

In relating our experiences in this endeavor, we are not unmindful of the fact that any newcomer in the field of therapy is bound to be received by the medical profession with skepticism or ignored entirely. In self defense we are now submitting the theory on which this work was based and attempting to chronicle accurately and conservatively the phenomena observed following this treatment. While we realize that coincidence plays some queer tricks and that suggestion cannot be ignored, we do not believe that psychotherapy played any important part in these cases.

Irradiation has been used before this in the treatment of essential hypertension. The French particularly have reported success in some cases of essential hypertension by irradiation of the adrenals.[2, 3] Other writers report a fall in blood pressure following irradiation of the carotid body. In this country a few men have applied the x-ray to the adrenals in the treatment of hypertension, but without success.[4] It is believed that this is the first time that both the pituitary and the adrenals have been x-rayed at the same time for the treatment of these syndromes.

History and Statistics

This work has been in progress for three years. During that time there have been treated under our supervision 177 cases of essential hypertension, 21

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 11, 1935.

cases of hypertension and diabetes existing in the same patient and 46 cases of diabetes mellitus without hypertension.

Essential Hypertension. — Of these cases, 43 either discontinued treatment before enough was given to determine whether their hypertension was amenable to this form of therapy, or could not be followed. Of the 134 others, 99 have improved and 35 have not improved; that is, of those receiving an adequate amount of treatment 73.88 per cent are improved. By improved we mean that their symptoms have been relieved and their blood pressure has been reduced either to normal levels or more than 30 points on the systolic or 20 on the diastolic. In most instances we have made no effort to reduce the blood pressure to theoretically normal levels, as we believe that patients who have been victims of hypertension for several years need a higher pressure than normal healthy persons.

Diabetes and Hypertension. — Twenty-one patients with both hypertension and diabetes have been treated, 14 men and 7 women. Of these, 8 have improved as to both conditions, 7 as to hypertension only and 3 as to diabetes only. Three patients either had insufficient treatment or could not be followed.

Experience of Other Men. — Martin[4] has had one of his associates under observation for thirteen years, using x-ray therapy as needed. The treatment began when the doctor was 57 years old and had a variable blood pressure reading of 180-200/118, which had existed for several years. He has had five treatments during those thirteen years. His blood pressure recently was 150/88. Martin says he has treated about a hundred patients who had infected tonsils and were also victims of hypertension. The x-ray treatments were given for the infected tonsils. About 80 per cent of these patients experienced considerable reduction in blood pressure. Martin believes that this reduction in blood pressure occurred because the tube was so placed that he unintentionally rayed the pituitary as well as the tonsils. Trostler[4] reports the successful treatment of 38 cases. The percentage of improved cases is not stated. Baker[4] has treated nine cases and has seen some improvement in seven. Men in various parts of the United States report about a dozen cases that are said to have experienced a considerable reduction in blood pressure and symptomatic relief following irradiation of the pituitary and adrenals.[4]

Response to Irradiation

The same technic is followed in recording blood pressure before, during and after treatment. The minimum pressure is recorded in every instance. The pressure is usually taken on both arms. It is rarely at the same level on both sides. Not infrequently there is a difference of as much as thirty points between the pressure in the right and left arm. This difference is less marked after treatment.

Symptoms such as headache, vertigo and tinnitus are usually promptly relieved. Precordial distress is also relieved. Probably 75 per cent of the patients who experience any improvement in their blood pressure state that they are mentally more alert, "more clearheaded," as they put it, and that there is an increase in their physical endurance. Most patients say that they are less irritable.

Many patients show a skin reaction characterized by a tendency to become smoother, softer and more moist. A few have experienced a considerable loss of superfluous hair. One patient had a severe scaling form of psoriasis from which the scales promptly disappeared.

Four patients have been treated who had typical symptoms of Graves' dis-

ease, including a well marked elevation of the basal metabolic rate. Three of them had had a subtotal thyroidectomy. One had been operated upon once, another twice and another three times, with the symptoms still persisting. These were relieved following irradiation of the pituitary and adrenals. The patient that had had two operations showed a drop in B.M.R. from plus 56 to plus 18 per cent, while her blood pressure declined from 205/75 to 130/78 following six x-ray treatments to the pituitary and adrenals. Another had a B.M.R. of plus 48 per cent and a blood pressure of 170/100. After three treatments the blood pressure was 145/90 and the B.M.R. was minus 6 per cent.

Method of Treatment

Our first treatments were given with the following factors:

	KVM	Port	Filter	STD	MA.	Time	MAM
R. pituitary	110	10x10 cm.	1 mm. Al. 0.25 mm. Cu.	50 cm.	4	20 min.	80
L. pituitary	110	10x10 cm.	Same	50 cm.	4	20 min.	80
Adrenals	110	15x15 cm.	Same	50 cm.	4	20 min.	80

This was gradually increased until in a few instances we used the following:

	KVM	Port	Filter	STD	MA.	Time	MAM	RU
R. pituitary	180	10x10 cm.	1 mm. Al. 0.25 mm. Cu.	50 cm.	5	15 min.	75	142.5
L. pituitary	180	10x10 cm.	Same	50 cm.	5	15 min.	75	142.5
Adrenals	180	15x15 cm.	Same	50 cm.	5	20 min.	100	190

All patients treated with this dosage experienced an unpleasant reaction characterized by headache, vertigo, weakness and occasionally nausea. Blood pressure was not materially reduced in any case. In the last few months we have used the following factors:

	KVM	Port	Filter	STD	MA.	Time	MAM	RU
R. pituitary	120	10x10 cm.	2 mm. Al.	50 cm.	5	7 min.	35	76
L. pituitary	120	10x10 cm.	2 mm. Al.	50 cm.	5	7 min.	35	76
Adrenals	120	15x15 cm.	2 mm. Al.	50 cm.	5	7 min.	35	76

Our experience justifies the hope that most cases of essential hypertension can be symptomatically relieved and the blood pressure reduced to much safer levels with very small doses of the rays. Larger doses are definitely not helpful. The patients suffer unpleasant reactions and the blood pressure is not materially affected. In this case at least, R units is not the most important factor. That is, 120 KV, 4 ma., 50 cm. STD, 10 min., giving 100 R does not have the same effect on the patient or his blood pressure as 200 KV, 30 ma., 1 min., giving 100 R. We have a feeling that rays having longer wavelengths are more effective than the very short wavelengths.

At first the treatments were administered at weekly intervals until six were given. Nowadays we do not order subsequent treatment until it is evident that no further reduction is to be expected as the result of what has already been given, whether it has been one or several treatments. In some instances the blood pressure continues to decline months after treatment is discontinued until it reaches and maintains a normal level. If treatments are repeated at too frequent intervals, it appears that in some instances they tend to produce a recurrence of symptoms. This was noted particularly in Mrs. M. This lady, aged 52, the wife of a physician, had known of her hypertension for ten years. When she came under observation her blood pressure was 260/130. After one treatment with the following factors: 120 KV, 2 mm. aluminum filter, 50 cm. STD, 4 ma., 7 min., 70 RU, 10x10 cm. portal for each side of the pituitary and a 15x15 cm. common portal for the adrenals, the blood pressure declined to 170/110 and she became entirely symptom free. Following a second treatment to the adrenals

only, given twelve days after the first, her blood pressure rose within forty-eight hours to the original level and her symptoms all returned. Following further treatment to the pituitary and adrenals she became symptom free and her blood pressure declined slowly to 185/85.

Discussion

Controls. — The general record of medical treatment of essential hypertension offers some control for any new form of therapy proposed. The cases under our immediate supervision have for the most part been under the observation of either the Illinois Central Hospital Department or of other doctors for some years, so that the status of their hypertension was well understood and various forms of therapy had already been used over a period of several years.

The various operative procedures designed to lower blood pressure or improve carbohydrate tolerance also tend to lower the functional level of the adrenals, whether, as in Houssay's work,[5] by removal of the pituitary influence or by adrenal denervation, splanchnic resection or sympathetic ganglionectomy.

Cause of Failure. — In a number of unsuccessful cases films of the sella showed it to be rather small, sometimes almost roofed over, and in none of these cases has there been any excess calcium in or about it. On the other hand, most cases that are rated as improved have shown an excess of calcium in or about the sella. In a good many cases the sella was at the upper limit of normal for size. In others the posterior wall appeared irregular.

That age is not the determining factor is illustrated by the following case histories:

Case 1. — Mr. F., aged 66, had known of his hypertension since he was 50 years old. When he came under observation November 27, 1934, his blood pressure was 240/125. He had his first treatment December 6, 1934, with the following factors: 130 KV, 2 mm. aluminum filter, 50 cm. STD, 5 ma., 10 minutes, 65 RU, 10x10 cm. portal to each side of the pituitary and 15x15 cm. common portal to the adrenals. Within a month his blood pressure dropped to 165/85. There was some rise after that. He had six more treatments up to June 18, 1935, when his blood pressure was 180/88.

Case 2. — Mrs. Y., aged 34, had known of her hypertension for ten years. She came under observation October 17, 1934, at which time her blood pressure was 260/155. Up to May 20, 1935, she had eighteen x-ray treatments. Most of them were directed to the pituitary and adrenals at the same sitting; however, a few were directed to the adrenals only. Her blood pressure now is 200/116.

While her blood pressure has been materially reduced and her headache and precordial distress are less troublesome, the blood pressure is still much too high and in spite of the reduction we do not count her among the patients who are regarded as improved. Her sella was smaller than normal and appeared to be almost roofed over.

Case 3. — Mr. L., aged 53, had known of his hypertension since an attack of "flu" in 1931. Partial paralysis of the left side in May, 1934, lasted ten days. When he came under observation November 24, 1934, his blood pressure was 190/100. Because of his age and the history of a light stroke, it was felt that there was little likelihood of relieving him by this form of therapy. However, his symptoms were markedly and promptly relieved. His last x-ray treatment was on April 27, 1935. On July 13, 1935, his blood pressure was 150/80 and he was symptom free.

We have observed but two cases that experienced an infection after treatment was instituted. One had an attack of rheumatic fever during which the blood pressure rose to its original level. After further x-ray treatment it was reduced almost to normal. A second attack of rheumatic fever was not accompanied by any rise in blood pressure. Another case experienced a "flu" infection after his blood pressure had been considerably reduced. During the infection his blood pressure is said to have risen to the original level. After recovery his blood pressure was near the level it had reached before the onset of the infection.

Diabetes. — Barnes,[4] working in Carlson's laboratory at the University of Chicago, has produced diabetes in dogs by pancreatectomy. After their insulin requirement was determined, the pituitary and adrenals were x-rayed by Dr.

Culpepper. Their insulin requirement was reduced on the average fifty per cent. That is, if the dog was taking 30-40 units of insulin, after three or four treatments this could be reduced to 15 or 20 units. Barnes says: "Since the improvement seen is similar to that observed after ablation of the medulla of the adrenal, and since the improvement is not as marked as after removal of the pituitary, it is suspected that the action is largely on the adrenal and little if any on the pituitary." Six normal dogs were x-rayed over the adrenal region from one to seven times. They were sacrificed for epinephrine assay, and in each case the secretion of epinephrine was below normal. One x-ray treatment decreased the secretion somewhat, but four or five treatments reduced it to one-sixth or one-tenth of the normal output. Small doses of the ray were apparently more efficacious than larger ones. The dosage used most frequently was 120 KV, 5 ma., 50 cm. STD, 2 mm. aluminum filter, 15 minutes to the adrenals and to each side of the pituitary.

We have had under observation 46 diabetics. Ten received an amount of treatment inadequate to determine whether their eventual response might have been favorable or otherwise to this type of therapy. Twelve were unimproved Five claimed to be symptomatically improved (disappearance of headache, increase in strength and in their sense of well-being) but without any change in their carbohydrate tolerance. Nineteen were improved both symptomatically and as regards carbohydrate tolerance.

Some of the patients classed as unimproved showed considerable reduction in their insulin requirement when they first began treatment. One patient dropped from 36 units of insulin per day to 16, and another dropped from 45 to 14 units per day. Later there was an increase in insulin requirement, which, however, did not reach the amount required prior to treatment. The difference, however, was too slight to be noteworthy.

Among the improved, six have been able to discontinue insulin and maintain themselves without hyperglycemia or glycosuria. They were taking from 5 to 35 units per day. Others showed the following reduction in insulin:

Case 1.....from 60 units per day to 25 units per day
Case 2.....from 45 units per day to 15 units per day
Case 3.....from 20 units per day to 10 units per day
Case 4.....from 20 units per day to 10 units per day
Case 5.....from 24 units per day to 6 units per day
Case 6.....from 40 units per day to 25 units per day
Case 7.....from 80 units per day to 48 units per day

A few cases may illustrate what happens clinically.

Case 4. — Mr. G. S. Diabetes was discovered in 1926 at the age of 42. Fasting blood sugar October 9, 1929, was 200 mg. Weight, 207 pounds. He could not be persuaded to stay on any reasonable diet. During an attack of rheumatic fever in 1931, he began to take insulin 10 units night and morning. This continued without change until 1933. Two x-ray treatments were given to the pituitary and adrenals in December, 1933, seven years after the discovery of the diabetes. He became sugar free after the second treatment and stopped insulin. During the Christmas holidays in 1933, his diet was even less restricted than usual and he developed mild glycosuria. A third x-ray treatment was applied to the pituitary and adrenals January 19, 1934. He shortly after became sugar free and, while remaining on about the same diet, has continued without hyperglycemia or glycosuria ever since.

Case 5. — Mr. H. aged 53. His diabetes was discovered shortly after an attack of mumps at the age of 45. His hypertension began two years later. Subjectively he complained of weakness, diplopia, severe headache requiring the use of morphine, and transient attacks of blindness. He did not take insulin and spilled sugar most of the time. After a few treatments the glycosuria disappeared and has recurred but once since that time. His blood sugar has been normal for about two years. His blood pressure stays within ten points of 165/95. Following a prolonged physical and mental strain some months ago he had a recurrence of most of his symptoms and a marked elevation of blood pressure but without glycosuria or hyperglycemia Following a rest period and a few x-ray treatments the blood pressure again declined to the figure mentioned.

We have done 67 glucose tolerance tests on 65 patients with hypertension. Forty-three patients showed a diabetic type of sugar curve, the blood sugar rising to more than 170 mg.

It would be ideal to have diabetic patients in the hospital on a measured diet for two weeks before treatment is started. Unfortunately, ours is not a research institution and this is impossible. When a patient, however, has been taking insulin for some years and following irradiation of the pituitary and adrenals finds himself rather rapidly able to dispense with its use without hyperglycemia or glycosuria and without change in diet, it is not unreasonable to assume that the treatment had something to do with the change in carbohydrate tolerance. Moreover, the experience of Barnes and Culpepper in the treatment of totally diabetic dogs furnishes confirmatory evidence that irradiation of the pituitary and adrenals does improve carbohydrate tolerance.

The objection has been raised that this is a dangerous procedure, but the x-ray has been used in much heavier doses both to the pituitary and the adrenals without damage to these organs or neighboring structures.[6]

The objection may be raised that symptomatic improvement is due to suggestion on the part of either the patient himself or the doctor. But patients who experienced little improvement were subjected to the same sort of psychologic influence as were those that responded favorably. Patients who received heavy doses of irradiation were offered the further suggestion that treatment was being changed in the direction of making it stronger and consequently more effective, but they experienced no relief and no material reduction in blood pressure. These same patients experienced considerable reduction in blood pressure when they were given light doses of the x-ray.

Summary

1. The use of x-ray in the treatment of diabetes mellitus and essential hypertension is based on the belief that these two syndromes are due to some abnormal function of the pituitary or adrenals and that this abnormality can be corrected by irradiation of these structures.

2. The work has been in progress three years. During that time there have been 177 cases of essential hypertension, 21 cases of hypertension and diabetes existing in the same patient and 46 cases of diabetes without hypertension. Among the patients having essential hypertension 43 either had an inadequate amount of treatment or could not be followed. Of those that had an adequate amount, 99 or 73.88 per cent definitely improved both as to relief of symptoms and reduction of blood pressure. Of the 21 cases having hypertension and diabetes 8 were improved as to both conditions, 7 as to hypertension only and 3 as to diabetes only, and 3 either had an insufficient amount of treatment or could not be followed. Of the 46 diabetics, 10 received an inadequate amount of treatment. Of the remaining 36, 12 were unimproved, 5 claimed symptomatic improvement but without change in their carbohydrate tolerance, and 19 experienced some improvement both symptomatically and as regards carbohydrate tolerance. The best responses have been obtained with very small doses of the x-ray.

3. One hundred and fifty-nine cases are reported as being treated by other men. Of these, 137 are said to have experienced improvement following treatment.

4. The final evaluation of this form of treatment depends on time and the accumulation of a large series of cases by ourselves and other men in various parts of the country. The treatment is not offered as a cure but as an addition to our armamentarium for the treatment of these two syndromes.

30 North Michigan Avenue.

Conclusion

This mode of therapy is not offered as a cure for these syndromes but in the hope that it may become an addition to our armamentarium. It is hoped that in a small measure it will help to distract attention from the pancreas as the sole cause of diabetes. The pancreatic theory of diabetes is no longer justified by evidence in its support.

We believe our experience is already sufficient to answer the objection that the effects are the result of either coincidence or suggestion. The final evaluation of this form of therapy will require a good deal of time and a much larger series of cases than is here presented. Whatever good comes from this treatment is produced by means of small doses not too frequently repeated.

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Discussion

Dr. Roy W. Fouts (Omaha, Neb.): Everyone who is familiar with the biological action of x-ray radiation knows that the more highly specialized a gland becomes, or the more active it is either physiologically or biologically, the easier or more readily will it respond or its function be influenced by the radiation.

It is no longer a debatable question whether or not the basal metabolic rate can be lowered from a forty, fifty or sixty plus to normal or subnormal by x-ray radiation of the thyroid gland. Neither is it debatable whether or not it is possible to radiate the ovaries and bring about artificial menopause. These are two facts that have been established. We believe all endocrine glands are interrelated and are just as easily influenced by x-ray radiation as are the two I mentioned. It seems only logical, then, that the pituitary and the adrenals would respond the same way. This furnishes a basis for the rationale of this treatment in endocrinic conditions.

The essayist stated in his paper that in the hyperfunctioning states of the adrenals, in the pituitary we get increased blood pressure and a hyperglycemia, in contradistinction to the hypo-functioning states when we get a lowered blood pressure, lowered blood sugar, and increased sugar or glucose tolerance.

Knowing that the x-ray will limit or inhibit the action of these two glands that seem to play in our body metabolism, the treatment doesn't seem at all farfetched. To me, it appears logical and rational. The number of cases which the essayist has presented is not large, yet with an improvement in seventy-three per cent it seems to justify commendation of the treatment and certainly continuation along this line. I shall try it.

Dr. H. D. Holman (Mason City, Iowa): In looking up the appropriate literature I found references to the treatment of dibaetes through the pancreas, it being stated that the pancreas was affected very little by the x-rays, and that this type of treatment probably was more or less questionable and was more or less dangerous because of the fact that one was treating through certain glands where they might do considerable damage.

Those factors all being true, we find that hypertension is divided into possibly a primary and a secondary type. Most of us can take care of secondary hypertension and medicinal agents, but when we come to the primary ones, the essential hypertensions, we are absolutely helpless. That being the case, one has everything to gain and nothing to lose. A man hasn't very long in this world after he has a hypertension that is very high and that cannot be remedied by ordinary methods. If the essayist gets the results he has stated in the essential hypertension type, he is making a valuable contribution to therapy.

I would like to have him explain a little more definitely his technic.

Dr. Harold Swanberg (Quincy, Ill.): Dr. Hutton is to be congratulated in presenting the results of his observations, because it is really a radical and comparatively new procedure in therapeutics. I want to emphasize what the previous speaker has said about essential hypertension. This is a common disease and a most serious one. Up to the present time, we have had nothing in our therapeutic armamentarium that would do very much for the patient.

During the last year we had the opportunity of treating about twelve cases

of essential hypertension with about the proportion of success that Dr. Hutton has reported. We had some failures. One patient I have been especially interested in, is the father of one of our younger physicians, who has made an unusually careful study of this case.

He came to us in October of last year, forty-eight years of age, and with a history of having had a slight stroke a few weeks ago. At the time he was first examined his blood pressure was 240/120. After some weeks of rest in bed, with the ordinary medicinal treatment, which, of course, is very ineffective, we were able to get the blood pressure down to 200. It ran between 200 and 210/110. His son had heard about the treatment and asked me if I would be willing to undertake it.

We gave this man one treatment according to Dr. Hutton's method. The blood pressure was taken five days later. Bear in mind, it was 200 at the time of the treatment was taken. Five days later he had the lowest blood pressure he had had in a good many years. It went down to 130. To make a long story short, we have given this man, since that time, a series of twelve treatments in accordance with Dr. Hutton's method, which consists of giving the dosages about once a week. We gave three series of four treatments, with rest of a month in between the series.

Just before I came here, I called the young colleague and asked him how his father was getting along. The last treatment we gave him was Feburary 20 of this year, about five months ago. I learned that his father's blood pressure just a few days before was 140/198, and since the treatments had been given, had never risen above 165.

This was a typical case of essential hypertension in which a very careful investigation was made from every standpoint, and which presented the apparently hereditary type which ran through the family.

I am presenting this to emphasize that the treatment merits further consideration.

Dr. James H. Hutton (closing): I wonder if Dr. Fouts understood we gave this woman treatment over the thyroid. We didn't. The treatment is directed to the pituitary and adrenals and for the hypertension, without influence on the basal rate. So far as danger is concerned, the brain has been x-rayed for tumor ever since there was an x-ray machine, with much larger doses than we contemplate using, and no one has yet recorded any damaging effect on the pituitary or on the neighboring structures.

There were some young men in Dallas who treated some dogs for diabetes, but they tied the dogs down and ran the machine for eight hours, gave them 2500 R units, and there was some damage. Obviously, we don't do that with the human.

I would like to emphasize what I tried to show on one of the slides. If these treatments are given too close together, for some unaccountable reason we get bad effects after the second or third treatment. We noted it in this one woman, and we have since been very careful not to give the treatment so long as there appear to be good effects from the former. We don't regularly give them every week until six are given, as we did originally.

I realize that many who treat diabetes take no stock in this at all, and I neglected to tell you what we had done about it. Dr. Carlson, at the University of Chicago, got considerably interested in this, as did Dr. Barnes, who followed the work of José. For the information of those of you who have not read his work, he removed the pituitary of a dog, and when it recovered from the operation (dogs do recover and live very nicely without a pituitary) he removed the dog's pancreas. The dog did not develop diabetes and was able to metabolize a large amount of carbohydrate without glycosuria or hyperglycemia. That is something they haven't yet explained. Dr. Barnes took a series of dogs (I think he has had a dozen now) and removed the pancreas so that they were totally diabetic. He stabilized them as to diet on insulin. He drained the pituitary and adrenals, or rather Culpepper did, in the same machines we used on patients. After three or four treatments, they required insulin only, twenty-five per cent of what it was before treatment. Barnes obtained the same effect we had with the patient. He had a dog whose insulin requirement was twenty-five per cent or a little less. The dog not only did not get better, but definitely worse and required more insulin than when the heavy dosage was given. He never did regain the ground lost following the heavier treatment.

We had forty-six diabetics, and only nineteen improved as to carbohydrate tolerance and symptomatic improvement. A good many more have experienced symptomatic improvement, but only nineteen have shown an improved carbohydrate tolerance. We have no idea why one can take a totally diabetic dog and bring about more improvement than we can with patients not obviously diabetic. That is one of the clinical problems we are confronted with.

I hope nobody will go away with the impression that I have said this is a cure for hypertension or diabetes. The most we hope for is that somebody will try it out, and maybe eventually it will be adopted as an addition to our armamentarium.

A NEW VAGINAL DIATHERMY ELECTRODE

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The method which we employ for the treatment of gonorrhea in the female consists in the elevation of the systemic temperature with coincidental elevation of the temperature of the pelvis to a level exceeding that of the other parts of the body. This technic is based on the belief that as high a temperature as can safely be employed should be applied in the tissues harboring the micro-organism; namely, the tissues of the pelvis. While the systemic temperature is elevated to about 105-106 degrees F., we attempt to raise the tissues of the pelvis to about 110-111 degrees F. Such a local temperature may be maintained for a period of three and one-half to four hours without doing any damage to the tissues of the pelvis. This differential high increase in pelvic temperature is achieved with diathermy, while the patient's systemic temperature is maintained at its elevated state by means of photothermal radiation administered in a cabinet.[1]

By means of diathermy alone applied with vaginal electrodes, it is possible to achieve substantial temperature elevation of the tissues of the pelvis.[2]

We have used various types of vaginal electrodes such as cylindrical ones, and those developed by Chapman and Derow. Occasionally we have found these electrodes unsatisfactory because their shape or length did not permit more or less equal heating of the tissues harboring the gonococci. Sometimes the urethra would be inadequately heated, and at other times the cervix.

In the effort to develop a vaginal electrode which would come into as close contact as possible with the structures surrounding this cavity, we made a series of paraffin and of plaster of Paris casts in twenty-five subjects. The paraffin casts were made by injecting this substance while in a melted state into the vagina by means of a syringe. The introitus was tightly compressed by the patient until the paraffin had become solidified. This technic was found unsatisfactory because the material was too soft to faithfully hold its shape during the process of removal. The plaster of Paris casts were satisfactory. They were made by pouring the plaster while in a relatively fluid state into a condom. The condom was tied after the air in it had been carefully excluded. It was then introduced into the vagina and held there by the patient, who pressed the labia minora together. The plaster became solidified within ten or fifteen minutes. It was then withdrawn by making traction on the exposed end of the condom, aided by pressure of a finger in the rectum.

The vagina being a distensible cavity, the varying quantity of plaster injected and the amount of pressure employed would influence the size of the cast. However, the forms which we secured resembled each other sufficiently in detail to permit us to obtain a more or less faithful outline as it actually exists in the living female.

The examination of the casts obtained from nulliparous and multiparous women indicates that, in general, they can be divided into three sizes. The smallest is $2\frac{3}{8}$ inches long and $1\frac{3}{16}$ inches in its greatest width; the medium sized one is $3\frac{1}{4}$ inches long and $1\frac{1}{16}$ inches at its greatest width; and the largest is $3\frac{3}{4}$ inches long and $1\frac{3}{4}$ inches at its greatest width. The essential characteristics of all the casts are more or less the same. The section filling the posterior fornix is broad and rounded, increasing in width and depth so as to fill the

Fig. 1. — Anterior view of vaginal electrode which conforms in anatomic outline to both the nulliparous and multiparous vaginal cavity. The metal body and hard rubber stem are hollowed to permit use of a thermometer for temperature reading. The cup-like groove in the metal part is shaped to the outline of the cervix.

Fig. 2. — A lateral view of the new vaginal cavity conforming electrode.

region in front of the cervix. It then tapers gradually to the region of the introitus. The anterior aspect of the cast shows a cup-like depression in which the ridges made by the outlines of the cervix and os can be readily detected. This depression varies from 1-4/16 to $1\frac{1}{16}$ of an inch in diameter. There is a shallow groove made by the tissues on the under surface of the urethra. When viewed on its lateral aspect the cast is seen to slope in a slight curve downward from the anterior portion, representing the region of the introitus, to the posterior portion representing the region of the posterior fornix. All areas of the cast are well rounded so that there are no sharp edges.

Metal electrodes patterned after the casts were made and attached to handles of insulating material. A channel extends from the handle well into the interior of the electrode, to permit the insertion of a thermometer.

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TREATMENT OF CARCINOMA OF THE LIP *

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Generally speaking, the treatment of carcinoma of the lip may be divided into five definite procedures. To obtain the best possible results, these should be carried out in a systematic and chronological order.

1. *Establishment of Diagnosis.* — When we speak of carcinoma of the lip, we usually visualize the disease as it affects the lower lip, because it is so much more frequent than carcinoma affecting the upper lip, which must not be lost sight of, and is included in this consideration. The preponderance of patients affected are men; a few instances occur in women. With the exception of a secondary anemia, which is present more often than one would expect, there are no concommitant general systemic conditions encountered, at least no more frequently than the age group furnishing most of the patients would warrant. The patient may present himself during the early or the late phase of the disease, thus one must familiarize himself with the appearance of the disease in its various stages.

Clinically there are two varieties of carcinoma of the lip: (a) the superficial or papillary, and (b) the deeply infiltrating type. Their appearance and course differ.

(a) *The Superficial papillary type.* — At the beginning this type appears as a slight nodulation, giving the patient little, if any, inconvenience. Slowly, but definitely, it increases in size and becomes firm; it protrudes from the mucosa, and after several months, shows small areas of ulceration. The progress of the disease is slow. The lymph nodes draining the affected area become involved but slowly, thus bearing out the frequent clinical observation that this type of tumor is of a lesser malignant character, at least during the first year. It is not unusual to see a tumor of this type of a year's duration without the presence of palpable lymph nodes. Later the picture changes — marked ulceration occurs, the ulcerated area is covered by an easily removable, thick, brownish or brownish-black incrustation, neoplastic nodules stud the periphery of the tumor, and lymph node involvement is easily elicited.

(b) *The deeply infiltrating type.* — The second variety is more serious because it is a much more rapidly metastasizing lesion. This type usually begins as a small, but deep and rapidly infiltrating ulceration, the borders of which show a tumefaction. The involved area is hard, the lymph nodes become involved early, and it is not infrequent to find a palpable lymph node two months after the inception of the original ulceration. The size of the lesion gives no indication of the seriousness of the condition, as often very small ones are associated with extensive lymph node involvement.

Diagnosis of either type of carcinoma, in general, is not difficult. One must, however, always bear in mind the possibility of the other diseases which, at times, resemble this clinical picture. The most important of these are: (1) chancre, (2) gumma, (3) nodulo-ulcerative tertiary syphilis, (4) tuberculosis.

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* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 11, 1935.

A few cardinal points in differentiation of these lesions from carcinoma of the lip are:

(1) A chancre appears and progresses rapidly, it takes but a few days to develop, and the lymph nodes become involved early and extensively. Both the primary lesion and the lymph node will lack the characteristic plaster of Paris hardness of carcinoma. Dark field and local serological examinations will of course, help out.

(2) The differentiation from the tertiary lesions of syphilis, from the nodulo-ulcerative or gummatous lesions, is more difficult. A careful history, serological examination, the presence of healed scars, configuration of the lesion, absence of hardness will all play an important part in the differential diagnosis. Bear in mind, however, the possibility of carcinoma of the lip developing in a syphilitic individual. This, however, does not occur with the frequency observed in carcinoma of the tongue.

(3) Tuberculosis of the lip is infrequent, but does at times resemble carcinoma. It usually appears as a necrotic mass relatively slow in development.

There is also the case where an absolute diagnosis is only possible by microscopic examination. I believe these instances to be rare.

The question of metastasis, of lymph node involvement is of paramount importance. This must be carefully elicited. Generally the earlier this develops the worse the prognosis becomes. Examine the neck of a patient with carcinoma of the lip carefully and meticulously. This is best done by standing back of the patient who is seated on a chair; then by flexing the head forward, palpate the entire neck with the same hand, not forgetting the submaxillary, the anterior and the posterior cervical chains.

Occasionally lymph node involvement denotes but an inflammatory adenitis due to the secondary invasion of pus producing organisms. Under these conditions, the nodes will be softer and will tend to be painful. These nodes disappear under radiation therapy.

2. *Examination and care of the oral cavity.* — This is the second step in the treatment of carcinoma of the lip. As a general rule, a marked oral sepsis will be found — unclean, discolored, tartar-covered, ill-kept, uneven, jagged, broken teeth, associated with spongy, hyperemic, easily bleeding and pus-yielding gums. The great majority of the patients are users of tobacco in one form or another. In order to prepare the patient for treatmen, the oral sepsis must be corrected, the mouth must be put into the best possible condition, the use of tobacco discontinued and the patient instructed how to keep his oral cavity clean.

3. *Treatment of the local lesion.* — Many types of agents have been advocated and may be used to accomplish the ultimate aim of this endeavor, that is, the complete eradication of the existing new growth, and under certain conditions one must adapt the procedure to the patient rather than vice versa. In the main, however, the best results obtainable follow the proper use of massive doses of superficial x-ray.

Stimulated by the reports of Pusey, Martin,* Grier, and others, I began to experiment with various doses of this type of therapy. The result of this work culminated in the use of the method is presented at this time.

The patient is placed in a prone position on a treatment table, the lip is firmly fixed, the unaffected areas are well covered with lead, the protecting shield being placed between the lip and teeth. The 6,000 r or 17+ erythema units of superficial x-ray are delivered into the lesion in one, two or three sittings, the entire dose being administered in a period of one week. The effect

* Martin, Chas. L.: Squamous Carcinoma of the Skin, Am. J. Roent. & Rad. Therap. **28**:728 (June) 1932.

of this irradiation is the development of a marked inflammatory reaction. The exposed area becomes blistered, a marked serous and sero-purulent exudation follows, which is later replaced by a markedly adherent incrustation. The entire inflammatory process lasts about four weeks.

At the end of this time the reaction subsides, and as it disappears it leaves in its place a soft, normal-looking tissue, indented from the loss of the diseased structures, and somewhat hyperemic for a period of about three weeks. Occasionally, when the carcinoma extends far into the mouth, the lip must be everted and the dose applied from more than one angle, so as to cover the entire lesion with the same amount of x-ray. The main object of this treatment is, in addition to the lytic action of x-ray on the malignant cells, the establishment of a marked inflammation. On account of this, no filter is used in delivering this dose. It is noteworthy that in my experience only those lesions in locations where a marked inflammatory reaction can be produced are benefited by the use of x-ray. This is more or less easily accomplished on the lips.

Comparison of this massive dose of x-ray with other therapy convincingly proves its efficacy. I would heartily recommend its use. The dose is easily given. The inconvenience which it produces is but slight; this occurs as pain during movement of the lips while the active blistering period is present. It is true that the lip becomes swollen, tense and reddened, will crack and bleed with the movements of the lip, but the period during which this occurs is relatively short and the result, I believe, warrants the inconvenience which follows.

The accompanying tables show the effects of this treatment in 71 patients.

4. *Therapy of the lymph nodes.* — I am very pessimistic regarding the results obtained by the treatment of the lymph nodes in carcinoma, except, of course, if the involvement is inflammatory. When the dissemination of the carcinoma makes itself apparent by lymph node involvement, there are certain therapeutic procedures which are at hand, but in the vast majority of cases the end result is going to be unsatisfactory. The simplest thing one can do is to cut down on the lymph node and implant it with sufficient number of radium emanation needles that each cubic centimeter receives 1 millicurie of radium. In spite of the reports emanating from other institutions, this form of therapy has been anything but satisfactory in my hands.

I am placing greater reliance on the use of heavily filtered deep therapy irradiation to this location, and I do believe that with the increased amount of copper filtration our results are going to be somewhat improved. I am convinced of the value of the use of this treatment before a lymph node involvement occurs, that is, of its prophylactic value in all patients suffering from carcinoma of the lip; 1500 r's are delivered, with deep therapy, to both sides of the neck.

5. *The last procedure in the treatment of carcinoma of the lip is the follow-up which is carried out after the intensive treatment.* As tobacco and oral sepsis seem to have some bearing on the original development of the lesion, one must be careful to ascertain that the bad habits of tobacco and oral uncleanliness are not resumed by the patient. The question of tobacco, especially, is a difficult one, for even the best patients will try to fool the examiner. The patient should be brought back once a month for the first year and once every two months for the next three or four years. At each examination, which should include the examination of the lymph nodes, the question of tobacco is raised, and if any teeth are still standing, the oral hygiene is checked up. At these follow-ups, the general health of the patient is to be measured by blood counts. This becomes important especially in individuals who show signs of secondary anemia.

TABLE 1.—*Carcinoma of Lower Lip*

Name	Age	Duration	Tobacco	Oral Hygiene	Location and Size of Lesion	Gland Involvement	Dosage	Photo	Deep Ther.	Result
R. T.	37	5 mos.	20 yrs.	Edent.	To the left of the center there is a small, indurated ulcer, .7 x .7 cm. in diameter. This followed immediately after removal of teeth.	None	6,000r	B–A	Yes	Good
W. L.	67	2 yrs.	47 yrs.	Edent.	One cm. to the right of the midline, a superficial, denuded area .75x .75 in diameter. This followed extraction of 25 teeth.	None	6,000r	A	Yes	Good
A. J. B.	43	11 mos.	28 yrs.	Bad	On the left lower lip, an indurated, rounded lesion, 1 cm. in diameter.	None	6,000r	B–D–A	Yes	Good
J. L.	73	2 mos.	58 yrs.	Bad	A flat, ulcerating lesion, firm, hard, indurated, with adherent crust, deeply infiltrated, 1 cm. in diameter.	None	6,000r	B–A	Yes	Good
J. B.	58	3 mos.	48 yrs.	Bad	On right side, a flat ulcerating lesion 1 cm. in diameter.	Yes	6,000r	No	Yes	Good
Wm. S.	61	2 mos.	46 yrs.	Edent.	On right side of lower lip, a round, slightly raised lesion 1.0 x .03 cm. Surface is ulcerating.	None	6,000r	No	Yes	Good
J. H.	57	3 mos.	37 yrs.	Bad	At the middle of lower lip, a small, elevated, hard, dry, crust covered lesion, 1.0 x .5 cm.	None	6,000r		Yes	Good
G. C.	56	1 mo.	46 yrs.	Bad	On the right side of lower lip, a rounded, indurated, hard lesion 1 x 1 cm.	Yes	6,000r	No	No	Good
A. N.	58	1 yr.	25 yrs.	Good	On right side of lower lip, a firm, indurated lesion, 1 x 1 cm.	None	6,000r	No	Yes	Good
S. E. H.	63	14 mos.	45 yrs.	Edent.	On the left side of lower lip, near the commissure, a small, hard lesion with ulcerating surface, 1 x 1 cm.	None	6,000r	No	Yes	Good
P. O'D.	54	1 yr.	32 yrs.	Bad	On right side of lower lip, a superficial, hard, oval-shaped lesion, 1 x 2 cm.	Yes	4,000r		Yes	Good
C. Z.	48	4 mos.	13 yrs.	Bad	An elevated, moderately hard, warty lesion 1.2 cm. in diameter, on right side of lower lip.	None	6,000r		Yes	Good
J. E.	84	1 yr.	Does not use	Edent.	On left side a superficial ulceration 1.2 cm. in diameter, with pearly borders.	None	6,000r	No	Yes	Good
E. S. R.	62	3 yrs.	50 yrs.	Bad	On the left side of lower lip, an indurated lesion, 1.2 cm. in diameter.	None	6,000r	No	Yes	Good
R. E.	82	3 mos.	65 yrs.	Edent.	On the left side of lip, a hard, ulcerating lesion 1.2 cm. Entire surface is cracked.	None	6,000r	B	Yes	Dead
P. McC.	63	2 yrs.	40 yrs.	Bad	To right of midline, a rounded, indurated lesion 1.2 cm. in diameter.	None	6,000r		Yes	Good
S. W.	52	2 yrs.	32 yrs.	Bad	On left side an oval, crust-covered, slightly elevated lesion, 1.2 x .6 cm.	None	6,000r		Yes	Good
T. F.	54	9 mos.	34 yrs.	Bad	On left side of lower lip, a firm, hard, dry, scale and crust covered, punched out lesion, 1.2 x 1.3 cm.	None	6,000r	B–A	Yes	Good
R. McC.	40	2 yrs.	28 yrs.	Edent.	On left side of lower lip, an oval, raised, hard-bordered lesion, 1.3 x 1. Crust covered.	None	6,000r		Yes	Good
J. C.	72	1 yr.	50 yrs.	Edent.	To the right of the midline, a verrucous, crust covered, hard, infiltrating lesion, 1.4 cm. x 0.5 cm.	None	6,000r	B–A	Yes	Good
J. L.	39	8 mos.	24 yrs.	Bad	At the center of lower lip and extending to the left, there is a flat, hypertrophic tumefaction covered by a hard, dry crust, 1.5 cm.	Yes	6,000r	B–A	Yes	Good
H. M.	50	2 mos.	38 yrs.	Bad	At the right side of lower lip, an oval-shaped tumefaction, plaster of Paris hardness, 1.5 x 1 cm. Adjacent to it and extending almost across the entire lip is a white, rough, dry lesion, a leukoplakia.	None	6,000r	B–A	Yes	Good
T. F.	63	10 mos.	47 yrs.	Bad	In middle of lower lip, a hard, crust covered lesion, 1.5 x 1 cm. in diameter.	None	6,000r	B–A	Yes	Good

TABLE 1. — *(Cont.) Carcinoma of Lower Lip*

Name	Age	Duration	Tobacco	Oral Hygiene	Location and Size of Lesion	Gland Involvement	Dosage	Photo	Deep Ther.	Result
J. W. C.	68	6 mos.	Used to smoke	Edent.	On the right side of lip, a superficial, indurated lesion, 1.5 x 1 cm.	Yes	8,000r	B–A	Yes	Good
J. S.	61	1 yr.	40 yrs.	Bad	Close to the left commissure, a hard tumefaction with a central ulceration, 1.5 x 1 cm.	None	6,000r	B–A	Yes	Good
A. Y.	62	9 mos.	20 yrs.	Bad	In the middle of the lower lip, an ulcerative lesion, 1.5 x 1 cm.	Yes	6,000r	B–A	Yes	Good
J. K.	64	2 yrs.	52 yrs.	Bad	At middle of left side a depressed ulcer, measuring 1.5 x 1.2 cm. with hard edges, deeply infiltrated.	Yes	6,000r	No	Yes	Good
J. P.	56	1 yr.	Moderate Stopped 20 yrs. ago	Bad	On left side of lower lip, an elevated, hard, nodular, ulcerative tumefaction, 1.5 x 1.6 cm. deeply infiltrated.	None	6,000r		Yes	Good
L. F.	57	14 mos.	29 yrs.	Bad	Midway between the right commissure and center of lower lip, a raised, irregular ulcer 1.5 x 2 cm. Extends 1 cm. inside mucous membrane.	None	8,000r	B–D	Yes	Good
J. N.	64	2 mos.	40 yrs.	Bad	At the middle of lower lip, an elevated, solid tumor 1.75 cm. in diameter. Center is covered by a firmly adherent crust. Marked induration.	None	6,000r 5760 10r to new lesion	B–A	Yes	Good
J. N.	71	1 mo.	49 yrs.	Bad	On the right side of lower lip, a hypertrophic oval lesion covered by a thick, hard, elevated crust, 1.75 x 1 cm. in diameter.	None	6,000r	B–A	Yes	Good
L. G.	50	6 mos.?	30 yrs.	Bad	On right side, an indurated, round lesion 2 cm. in diameter.	None	6,000r	B–A	Yes	Good
F. C.	61	1 yr.	43 yrs.	Bad	On the left side of the lower lip, an oval-shaped, firm lesion with verrucous surface, 2 x 1 cm. in diameter.	Yes	6,000r	No	No	Good
J. M.	54	1½ yrs.	39 yrs.	Bad	In the center of lower lip is an oval, elevated dry, crust-covered, hard, indurated tumor, 2 x 1.0 cm.	Yes	4800 10r 6,000r	No	Yes	Very Bad
A. B.	55	4 mos.	43 yrs.	Bad	Near the left angle of the lower lip, a hard ulcer 2 x 1 cm.	Yes	6,000r	B–A	Yes	Good
G. O.	65	5 mos.	51 yrs.	Bad	On right side, extending to angle of mouth, an ulcerating process measuring 2 x 2.5 cm. Lesion is hard.	Yes	6,000r	B	Yes	In Extremis
P. H.	60	2 yrs.	48 yrs.	Bad	Just to the left of the midline, a hard, indurated, oval-shaped lesion 2.25 x 1 cm.	Yes	6,000r	B	No	Good
J. T. H.	76	4 yrs.	58 yrs.	Edent.	Advanced carcinoma of right commissure of mouth, 2.3 x 1.5 x 2.3 cm. in diameter.	Yes	6,000r	B–A	Yes	Good
G. D.	68	12 yrs.	50 yrs.	Bad	On the left side of lower lip, an ulcerating lesion with indurated borders, 2.5 x 1 cm.	Yes	6,000r	B	No	Bad
T. R.	77	5 mos.	60 yrs.	Bad	Resection for carcinoma of lip carried out at Bellevue Hospital in 1925. To left of this scar there is a punched out ulcer 2 x 2 cm.	None	6,000r	B	No	Good
J. H.	68	2 yrs.	30 yrs.	Bad	On the right side of lip close to the margin line, an ulcerative tumefaction, 2 x 2 cm.	Yes	6,000r	B–A	Yes	Good
A. P.	41	8 mos.	23 yrs.	Bad	On the right side of lower lip, a flat, raised, hard, ulcerative lesion, 2 x 2 cm.	None	6,000r	B–A	Yes	Good
Mrs. A. G.	80	6 mos.	Does not use	Bad	On the left side, a hard, nodular tumor, 2 x 2 cm. in diameter.	None	4,000r	B–A	No	Good
V. S.	39	4 mos.	24 yrs.	Bad	Just to right of center of lower lip, a superficial, hard ulcer, 2 x 2 cm.	None	6,000r	B	Yes	Good

TABLE 1.—*(Cont.) Carcinoma of Lower Lip*

Name	Age	Duration	Tobacco	Oral Hygiene	Location and Size of Lesion	Gland Involvement	Dosage	Photo	Deep Ther.	Result
F. L.	64	2 mos.?	46 yrs.	Bad	In the middle of the lower lip, a raised, irregularly outlined tumor, 2 x 2 cm., stony hard, crust-covered, with scar of biopsy—epidermoid carcinoma.	Yes	6,000r	B–A	Yes	Good
S. S.	77	1 yr.	57 yrs.	Bad	One-half cm. from left commissure of lip, a tumefaction 2 x 3 cms. There is a foul-smelling necrosis present. A sharp lower incisor tooth is situated opposite the tumor. The mucous membrane is involved.	None	6,000r	B	Yes	Dead
J. McK.	84	3 yrs.	69 yrs.	Bad	Just to the right of midline, an ulcerating lesion with punched out edges and crater-like center, 2.5 x 2.5 cm.	None	6,000r	B–A	No	Good
P. M.	47	3 yrs.	23 yrs.	Bad	In the middle of left side of lower lip, a somewhat superficial but hard tumefaction with central ulceration, 2.5 x 2.5 cm.	None	6,000r	B	Yes	Good
Wm. R.	61	6 yrs.	Does not use	Bad	In the middle of lower lip is a round, hard, elevated lesion 3 cm. in diameter.	None	6,000r	A	Yes	Good
J. DeM.	70	2 mos.	59 yrs.	Bad	Involving the entire right side of lower lip, an excavated ulcer 3 x 1.3 cm. Edges are raised and hard.	Yes	12,000r	B	Yes	Good
A. R.	57	2 yrs.	36 yrs.	Bad	On the right side there is a soft, irregularly outlined ulcerating lesion 3 x 1.5 cm.	Yes	6,000r	B	Yes	Good
F. P.	73	4 mos.?	63 yrs.	Bad	In the middle of the lower lip, an ulcerative lesion of plaster of Paris hardness, 3 x 2 cm.	Yes	6,000r	No	No	Good
C. G	82	4 mos	65 yrs.	Bad	On center of lower lip an ulcerative process 3.2 x 1.5 cm., somewhat more to the left than the right. Lesion is necrotic.	None	6,000r		Yes	Good
P. D.	44	9 mos.	21 yrs.	Bad	In the middle of the lower lip, an elevated, punched out, crater-like ulcer, 3.5 x 3 cm. The edges are board-like.	Yes	6,000r		No	Good
A. D.	39	2 mos.?	11 yrs.	Bad	Hollowed-out, crater-like ulcerative tumefaction covering about 4 cms.	None	6,000r	B	No	Dead
A. F.	56	1 yr.	38 yrs.	Bad	Involving the entire left side of lower lip, a hard, hypertrophic, ulcerating tumor, 4 x 2.2 cm. Lesion is dry and crust-covered.	Yes	6,000r		Yes	Good
S. O.	63	6 mos.	50 yrs.	Edent.	On right side of lower lip, tumor 4 x 3 cm.	Yes	6,000r	B–D	Yes	In Extremis
O. M.	57	4 yrs.	37 yrs.	Bad	In middle of lower lip an indurated, crust-covered, ulcerative lesion, 4 x 3 cm.	Yes	6,000r		Yes	Bad
J. M.	68	3 mos.?	53 yrs.	Bad	On right side, extending from angle of mouth to the middle of lip, a large, infiltrated, destructive lesion, 4 x 3 cms.	Yes	10,200r	B	Yes	Dead
J. L. Mc	71	4 yrs.	46 yrs.	Bad	At right angle of mouth, a tumor 4 x 6 x 2 cm. hard and firmly fixed. Numerous necrotic, excavated areas.	Yes	8,640r		No	Bad
F. W.	53	1 yr.	33 yrs.	Edent.	Entire lower lip with exception of left lower margin is involved in a destructive, irregular tumor, 5 x 2 cm. It extends inside the lip.	Yes	12,000r	B	Yes	Dead
M. M.	58	2½ yrs.	40 yrs.	Bad	Practically the entire lip is covered by a large tumor mass, 5.5 x 3 cms. It is stony hard, with a superficial ulceration.	Yes	6,000r	B	Yes	Good
W. R. Y.	48	2 mos.	28 yrs.	Good	Small, superficial, keratotic spot on middle of lower lip.	None	6,000r	No	Yes	Good
J. E.	58	1 yr.	46 yrs.	Bad	On left side a healed scar, the site of recent excision of a tumor mass. The area around this scar is infiltrated and firm.	None	5,760 10r 3,000r	No	Yes	Fair

TABLE 2. — *Carcinoma of Lower Lip with Lues*

Name	Age	Duration	Tobacco	Oral Hygiene	Location and Size of Lesion	Gland Involvement	Dosage	Photo	Deep Ther.	Result
A. K.	58	2 yrs.	40 yrs.	Bad	A huge destructive, nodular lesion involving the greatest part of the lower lip, upper lip and commissure of the lip.	Yes	12,000r	B–A	Yes	Dead
W. S.	70	1 yr.	50 yrs.	Bad	One cm. from the left commissure, just inside the mouth, a verrucous, hard tumefaction 1.5 x .5 cm. Leukoplakia present.	None	6,000r	B	Yes	Bad
S. K. R.	70	2 yrs.	50 yrs.	Bad	In the left corner of lower lip, a ragged-edged tumefaction of plaster of Paris hardness with superficial ulceration and nodulation, 2 x 3 cm.	Yes	12,000r	B	Yes	Bad
A. C. B.	50	1 yr.	30 yrs.	Bad	In the center of lower lip, an elevated, warty hard lesion 3 x 2 cm. in diameter. Patient also has four plus Wassermann.	Yes	6,000r		Yes	Fair

TABLE 3. — *Carcinoma of Upper Lip*

Name	Age	Duration	Tobacco	Oral Hygiene	Location and Size of Lesion	Gland Involvement	Dosage	Photo	Deep Ther.	Result
Mrs. L. M.	47	Lupus 29 yrs. Ca 17 yrs.	Does not use	Good	Slowly destructive lesion involving upper lip and right anterior naris.	Yes	6,000r	A	No	Good
H. W. M.	63	1 yr.	43 yrs.	Bad	Just to the right of the upper lip, a depressed ulcer with punched out edges, 1 x 1 cm.	None	6,000r	B–A	Yes	Good
W. S. R.	66	12 yrs.	40 yrs.	Bad	At right upper lip, an ulcerative, indurated lesion with neoplastic nodules, 4 x 2.5 cms.	None	6,000r	B	Yes	Good

Résumé of Tables

Total Number of Patients—71	69
Male	2
Female	37
Average Age of Patients—60.3 yrs.	
Youngest	84
Oldest	
Tobacco	
Number of Patients Using Tobacco	66
Number of Patients Not Using Tobacco	5
Average Years of Using Tobacco	39.8 yrs.
Oral Hygiene	
Bad	58
Good	3
Edentulous	12
Association with Lues	
None	67
Luetic	4
Location of Lesion	68
Lower Lip	3
Upper Lip	
Average Size of Lesion—2.06 cm. x 1.36 cm.	
Duration of Lesion	47
Less than one year	24
More than one year	1.7 years
Average duration	
Lymph Node Involvement	31
Present	40
Not Present	
Treatment—Massive doses of Superficial X-ray	
Result	56
Good	15
Bad	

Summary

The treatment of carcinoma of the lip may be divided into five different procedures:

1. Careful examination of the local lesion itself and serological examination of the patient.
2. Thorough examination and correction of any sepsis of the oral cavity.
3. Attack of the local lesion with massive doses of x-ray to produce a blistering dose, which, as it subsides, eliminates the carcinomatous tissue.
4. Treatment of the lymph nodes in the cervical region, whether palpable or not, with heavily filtered deep therapy irradiation.
5. Careful follow-up of the patient so that he does not go back to the use of tobacco or uncleanliness of the mouth, with a careful check on his blood count at the time of his reëxamination.

I believe that the establishment of such a régime will serve the best possible purposes in the treatment of carcinoma of the lip.

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Discussion

Dr. Roy W. Fouts (Omaha, Neb.): Dr. Hollander has chosen as a subject the one type of malignancy in which we can get more satisfactory results than in any other type with which I am familiar. However, in not all these type of cases, in my experience, are cures to be expected. Particularly is that true, as was stated, where we have metastasis. Fortunately, they metastasize slowly or late, in contradistinction to the gum or the lower jaw, which usually metastasize early, far and wide, even the squamous cell type with metastases in the neck and the cervical glands. That doesn't mean we should abandon a case, even though we see one with a small lesion and a large involvement of the neck.

We use higher voltage therapy than he employs. He didn't mention the voltage, which is of decided importance. I have never used a massive, unfiltered dose. I am going to use 6,000 roentgen units. We only use that on the lesion, just outside the infiltrated portion. In metastasis or secondaries of the neck, we use higher voltage x-ray, 200,000 "shooting" through from both sides.

Dr. Joseph L. McDermott (Kansas City, Mo.): The only thing I am concerned about is the after treatment, or the care of the reaction. At present all over the country it is common practice to file damage suits. I feel the essayist's method of treatment is all right in institutional cases where the patients could be kept under supervision. If a patient is allowed to go about and mingle with his friends, he will often receive advice that is not good. A great many malpractice suits have been instigated or caused through a careless remark by some physician. I think we should educate our fellow practitioners to be careful in discussing x-ray reactions. Many of them have seen very few reactions and are not qualified to pass an opinion. Radiologists are a little timid about using excessive dosage because of this state of affairs.

I would like to ask the essayist if he has any set method of caring for the reaction, anything that will rob it of its sting, lessen the swelling, or lessen the exudation. A short time ago I noticed in radiological journals and the Journal of the American Medical Association, that the use of alvovero, fresh leaves, would quickly cure any reaction. I took the trouble to write to the American Medical Association, and after about two weeks I got a reply that did not give me any information. They said some dermatologists had been using that method and couldn't give me details. They could not inform me where to obtain this medicine. Two New York wholesale drug houses were appealed to, and none of them could furnish this medicine. So I feel that sometimes methods are given wide publicity which will not stand the test of investigation.

Dr. Lester Hollander (closing): In the treatment of the lymph nodes we employ a little filter in deep therapy radium in conjunction with exposure of the lymph nodes. Whether one does or not adopt this depends, naturally, on the kind of carcinoma.

In regard to malpractice suits, I was very proud about two and one-half or three years ago when I was sued for the sum of $50,000. I thought that was quite a compliment to me. The suit was started by a patient in whom a certain number of devitalized and infected teeth were removed. My insuranec company would have taken care of it, but the judge just threw the case out. So will all good judges.

Since then, I make my patients sign away all their rights, privileges and prerogatives, with the full realization that in a death-bearing disease, where we have not been getting as good results as I think we are getting today with massive doses, one is within his rights to produce a marked roentgen dermatitis.

Dr. Roy W. Fouts (Omaha, Neb.): May I say just one word. Even though the doctor does take all precautions to have the patient sign away all his rights, it doesn't protect him in any way. It only has a deterring effect on the patient. It doesn't excuse negligence. If negligence is present, one is liable to a damage suit.

A NEW AIR-SPACED CUFF ELECTRODE

C. K. GALE, M.D.

NEW YORK

Short and ultrashort waves in medicine have definitely been established in the last few years. There can be no doubt of their therapeutic efficacy. However, this form of therapy is such a promising innovation that its greatest usefulness depends upon the development and clarification of methods of application and technic. It is not the purpose of this paper to compare the advantages and disadvantages of the various electrodes now in use but to present a new type which will facilitate the application and enhance the effects of short waves.

Among the modalities for the application of short waves has been the condenser electrode. Among the most efficient of this type is the cuff electrode, due to certain principles of electro-dynamics which will not be discussed here. The fact remains that the creation of deep heat within the tissues has been admirably and efficiently accomplished by this means. Heretofore, these electrodes have been spaced from the skin surface by felt or some other interposed dielectric. The disadvantage of using felt or any other type of solid material underneath the electrode has been recognized.

Because of the heat generated, and the lack of ventilation beneath the solid material covering the skin, there is apt to be a certain amount of sweating. If the sweat drops are permitted to come into contact with the felt or toweling used as spacing media, then the dielectric value of the felt is reduced, thereby changing the value of the air spacing intended to be used. Should the felt be moistened in spots and dry in other places, then we have the equivalent of different air spaced constants throughout the circumference of the cuff electrode. Concentration of the lines of force will be greatest in those areas where the dielectric is moist, thereby tending to cause burns. Until the present writing the use of air spaced condenser electrodes has not been applied, because of mechanical obstacles to the principle of the cuff electrode.

We present a cuff type of electrode which utilizes the principle and advantages of air spacing. This is accomplished in a simple and effective manner. A series of small bridges of non-conducting material are grooved so as to be readily applied to a standard rubber insulated cuff electrode. These bridges are arranged to permit several different spacings of the rubber insulated electrode from the skin. The portion of the bridge coming in contact with the skin is well outside the field of maximum intensity, in fact, it may be considered outside of the high frequency field, thus avoiding concentrations or heating of the dielectric. The surface of the skin exposed to the field is open to air which permits free evaporation of moisture, thereby avoiding the minute beads of perspiration which cause field concentrations and burns.

The individual bridge units are easily removed from the cuff allowing variations in its size, and thus giving a marked adjustability of a single cuff for circumferences of different diameters. The individual bridge units are further so moulded at their extremities that they allow circumflexion of the cuff with maximum facility.

The method of keeping the cuff in place is relatively simple. It is of importance in the practical use of air spaced cuff electrodes that there should be no downward pressure exerted on the rubber insulated electrode itself.

These mechanical bridges are applicable not only for the cuff type but

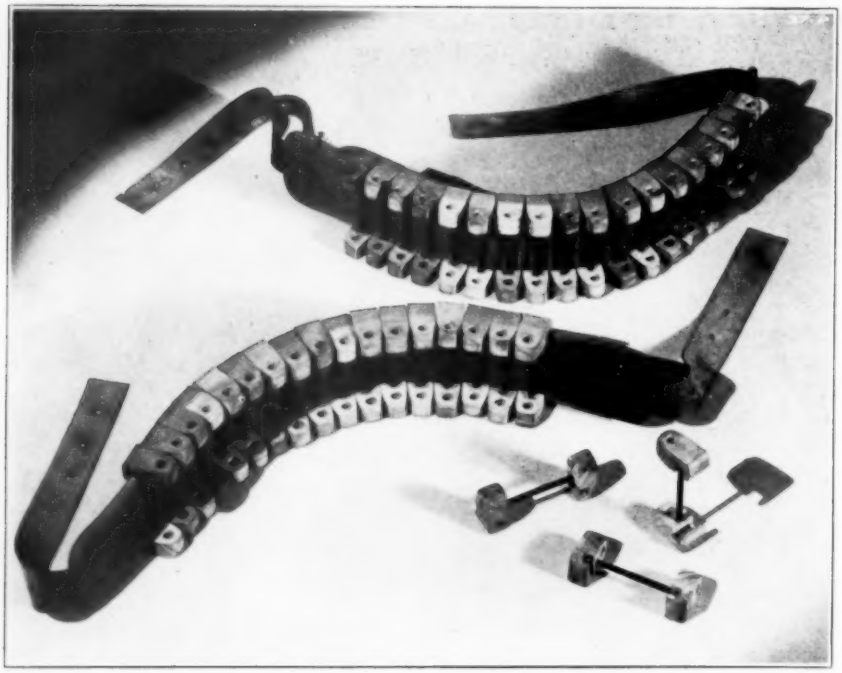

Fig. 1. — Flexible air-spaced electrodes in hyperextended and flexed position, demonstrating their adaptability. Lower right hand figures illustrate construction of each single unit.

for any flat type of electrode which has hitherto been separated from the skin surface by felt or other interposed material.

Our practical experience with the air spaced cuff electrode has been exceedingly satisfactory. We have given many treatments with a maximum facility of application, secure in the knowledge that the electrode is fool proof. We have tried various forms of tracks upon which the electrode was placed, that is, various forms of moulded projections from the edge of the electrode which were permanently adherent to the rubber electrode itself, of the type of various forms of bridges. We have found that the theoretical and practical difficulties encountered were best solved by the method already described.*

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* We wish to thank the Peerless Electro-Medical Company, of New York, for their cooperation in the development of these electrodes.

PRESENT TRENDS IN MANAGEMENT OF HYPERTROPHIED PROSTATE *

IRA R. SISK, M.D.

MADISON, WISCONSIN

The history of medicine affords no more interesting story than that dealing with the development of the treatment of the hypertrophied prostate gland. Almost from the date of the discovery of this gland by Ulassa about the middle of the sixteenth century attempts have been made to relieve by transurethral methods the distressing symptoms resulting from its enlargement. Tunneling of the gland was the procedure on which most of the early efforts were based. Hunter, Billroth, Mercier, and others tried these methods with little success and with great danger to the patient. Such efforts continued unabated however, until the prostatic surgical era which began in America in 1889, when Watson performed the first complete prostatectomy.

In the early days of prostatic surgery the mortality was very high but, as the surgical technic and the preoperative and postoperative treatment became better understood, both the suprapubic and perineal operations were developed to a high degree of perfection. The search for a satisfactory method of dealing with this condition without open operation continued, and as a result the modern transurethral resection of the prostate has developed and has gained great popularity. It is now used practically routinely in many of the large clinics.

The history of the development of this procedure has been related too often to need repetition. Tribute should be paid to Young, Caulk, Braasch, Sterns, McCarthy, Davis, and others who have contributed so much toward the perfection of the instruments and technic.

During the last fifteen years many instruments have been devised for resection. There are the instruments of Young, Caulk, Braasch, Collins, Foley, and McCarthy. Of these at least three have attained considerable popularity. These are, first, the electric cutting instruments resulting from the combined efforts of Sterns, McCarthy, and Davis; second, the instrument of Caulk which utilizes the cautery knife; and, third, that of Braasch which utilizes the cold knife. It seems unnecessary to discuss the relative merits of these instruments. Having had considerable experience with two of them and limited experience with the third, and having observed the work of others, I am convinced that all are satisfactory if properly used; and it seems more appropriate to emphasize the skill with which the instruments are used than the type of instrument.

Technically, transurethral resection is difficult. To acquire maximum skill one must perform the operation several hundred times. This probably accounts for the fact that much of the criticism which has been made of the procedure comes from men with limited experience, while the most enthusiastic and most successful resectionists are those with the greatest experience. Concrete evidence of the difficulty in mastering the technic of resection is manifest to those of us in teaching positions. At our institution men are trained for specialization in urology over a three year period, and we find it very difficult to teach the technic of resection without adversely affecting the results. On the other hand it is relatively easy to teach the technic of prostatectomy.

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* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 11, 1935.

* This paper concludes the symposium on transurethral resections. — Ed.

For successful resection three fundamental principles must be observed:

1. The removal of sufficient tissue to make it possible for the patient to completely empty his bladder and to insure him against early recurrence of symptoms is imperative. Because a patient who has had acute retention can void after operation does not necessarily mean that the operation has been successful. He must be able to completely empty the bladder. Furthermore, tunneling of large lateral lobes may give good results temporarily and the bladder may empty completely for a time, but large overhanging portions of lateral lobes will soon drop down and cause obstruction. Is it not probable that many incompletely operated patients are being and will be reported as recurrences? We have had to reoperate a number of our early cases, but have frankly told the patients that with greater experience we had learned that we had not been removing sufficient tissue.

2. Hemorrhage must be controlled.

3. An aseptic technic must be used to avoid the introduction of infection from the outside. Bumpus points out that much of our trouble with infection results from the introduction of new organisms from the outside — organisms to which the individual has no immunity. This may occur during the operation or during the postoperative treatment. Following Bumpus' ideas we have worked out a technic for resection which is just as meticulous as that for any major surgical operation, and the same care is followed in postoperative treatment by workers especially trained to carry it out, with the result that infection is now no more troublesome than it is following prostatectomy.

We have recently heard considerable criticism of the procedure of transurethral resection because of infection and prolonged sloughing. Strict observance of two old fundamental laws relating to the bladder will eliminate most of this trouble. The laws to which I refer are (1) the traumatized bladder is easily infected and (2) infection in the bladder cannot be dealt with very successfully in the presence of residual urine. Proper aseptic technic, then, and the removal of all obstructing tissue will to a very large degree solve this problem. On several occasions I have seen what appeared to be prolonged sloughing promptly clear up when a little additional tissue was removed, thus relieving a small amount of residual which remained after the first operation.

The question is frequently asked: "Why do you prefer resection to prostatectomy?" In answering this I would enumerate three reasons which to me are the most important:

1. In the institutions where transurethral resection has been used in large series of patients by resectionists who have developed great skill, the mortality is lower than for prostatectomy in the same institutions. In support of this statement I point to the report of Thompson of the Mayo Clinic who had a mortality of three-tenths of one per cent in a series of more than 630 cases; that of Alcock of the University of Iowa, who reported a mortality of 1.4 in his second 500 cases; that of Davis, who reported .82 of 1 per cent in 748 cases; and that of Nesbit of the University of Michigan, whose mortality was 6.25 per cent in 400 cases. These rates are considerably lower than those previously reported from the same institutions for prostatectomy. Furthermore, there is not recorded in the literature, to my knowledge, mortality rates as low as these for series of prostatectomies of equal size from any institution.

2. The average period of confinement to the hospital and of total disability are greatly reduced. The significance of this from an economic point of view is evident.

3. Almost all patients prefer resection to open operation, hence the patient is relieved of much mental anguish and many more are seeking aid in the earlier

stages of the disease before the kidneys are irreparably damaged and the general health permanently undermined.

A little more than three years ago we adopted transurethral resection practically as a routine procedure, and have resected the gland in more than six hundred patients. During this time we have done approximately twelve prostatectomies. The results in the first three hundred cases were studied in detail. The mortality was a fraction more than five per cent. The remainder of the records have not been reviewed as yet, but we feel that we have solved the problems one by one, and believe that every series of one hundred is being done more satisfactorily and more intelligently than the preceding one. Our mortality from prostatectomy over an eight year period immediately preceding the adoption of transurethral resection was exactly six per cent. These figures do not tell the entire story, as the records also show that when we were performing the open operation, one in five patients either died during the preoperative treatment or had some palliative procedure used, such as suprapubic cystostomy, because the condition was too poor to permit prostatectomy. On the other hand, resection has been used on practically all patients entering the hospital with enlargement of the gland.

Conclusion

Transurethral resection of the prostate is a practical procedure which can be carried out almost routinely in cases of hypertrophy of the gland. If the proper technic is used during and following the operation to insure the patient against infection with new organisms; if the hemorrhage is adequately controlled; and if sufficient tissue is removed to make it possible for the patient to completely empty his bladder, the results will be satisfactory and the procedure is preferred to prostatectomy. We have at this time no inclination to revert to the open operation which we performed for many years.

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Discussions of Papers by Drs. Ira Sisk, W. F. Braasch, Gilbert Thomas and H. C. Rolnick

Dr. H. Fay H. Jones (Little Rock, Arkansas): This symposium has been especially interesting because both types of prostatic surgery were so well presented. There have been innumerable publications during the past four years on this subject and, as demonstrated today, it is now down to a very firm foundation. Some men are practically 100 per cent resectionists plus the usual prostatectomy, either perineal or suprapubic. Resection and prostatectomy, depending on which is the most sane surgical procedure, is the road which we follow.

Our resections far outnumber our suprapubic prostatectomies, but in cases of large middle and lateral hypertrophies where it is necessary to remove at least 40 to 60 grams of tissue to establish free drainage we prefer prostatectomy. Dr. Thomas has very clearly brought out the point that we had most excellent results with prostatectomy before resection became so popular and that we should not forget that this is still a very good procedure in some types of hypertrophy of the prostate. Personally, I do not think it makes much difference whether one resects most cases and does prostatectomies on others. The main object, of course, is to relieve the patient with the least amount of pain, the lowest mortality rate, and the shortest possible hospitalization.

We are not fortunate enough to report as many cases as the different essayists have reported today. In our section the number during a year probably does not exceed 60, therefore our experience is limited. It is possible that, as time goes on and as we become more skillful with the resectoscope, we will be able to report a higher percentage of resections. However, at present, we resect at least 90 per cent of our cases. Dr. Sisk has par-

ticularly brought out the point that one cannot become a good resectionist until he has had several hundred cases. I know that we are doing better resection now than we did a year ago. We very seldom repeat a resection now, but two or three years ago it was often necessary to repeat the procedure. We do a great many suprapubic cystotomies because patients come in with the bladder distended and full of blood clots, having been traumatized by unsuccessful attempts as catherization, and evacuation can be accomplished only by surgery. Examination of several cases revealed a very large intravesical prostate which, after a few weeks of continuous drainage, shrank so markedly that satisfactory resection was done. We frequently see patients who do not tolerate the catheter to any satisfactory degree for whom suprapubic cystotomy for free drainage, with less irritation and discomfort, has been beneficial.

Dr. Thomas also mentioned a very important point in that when the idea of resection, or transurethral surgery, first made its appearance the enthusiasts minimized the procedure and it became known in the mind of laymen — and some practitioners — as a minor procedure, which is certainly not the case. A year or two ago it was not unusual for a patient to be referred to us by his physician for resection after having been told that since it was a minor procedure, he would probably be home in two or three days. Many times the physician did not discuss with the patient any idea of preparation which is as important for resection as for prostatectomy. As in all new things, the optimist took a very firm hold but we are very grateful that within the last few years the situation has simmered down to a very common sense procedure since every cystoscopist is not attempting to do resection and resection is now being done chiefly by qualified men. To me the highlight of the whole problem is that we are seeing these patients earlier than formerly and before prostatism causes a marked upper urinary tract pathologic situation which prolongs the preparation and convalescence periods. The other exceedingly gratifying outcome of resection is that we are able to do something for the majority of our patients with carcinoma.

Dr. Sisk mentioned two very important factors, namely: hemorrhage and infection. I do not think too much can be said about these two points. We know, of course, that hemorrhage should be controlled before the patient leaves the table. I am sure a number of us have been a little careless regarding our instrumentation, handling light cords which have not been sterilized, and there is no doubt that many infections have been due to faulty technic. Dr. Sisk is right in stating that we must be most particular with our technic.

Our oldest patient was 85 years of age; our youngest 23. The latter had a prefibrotic type of prostate, more or less of the congenital valve obstruction type, with congenital absence of the left kidney. He had a residual of 10 to 12 ounces, marked pyuria at all times and all the symptoms of prostatism. He also had pathologic urinary tract in the solitary kidney, namely: a dilated, tortuous ureter, marked hydronephrosis and pyelitis. Resection was done and the most gratifying results were obtained.

Quoting from Dr. W. Calhoun Sterling: "Prior to the advent of instrumental prostatectomy, the feud between those operating above and below 'the bone' consumed considerable time in urological meetings, the former group asserting that the mortality following perineal prostatectomy was much lower than that of the suprapubic operation." This feud has developed in the present form of resection versus prostatectomy. I think it is very fine to have different opinions, but after all is said and done, results are what we are after regardless of whether we obtain them by resection or prostatectomy. Personally I hope Dr. Lower and his associates and others who have been doing experimental research work for the control of prostatic hypertrophy will develop something concrete and that the time may soon come when, if we ourselves need relief from prostatism, it will be controlled by some type of sex hormone.

Dr. Thomas D. Boler (Omaha, Neb.): I wish to preface my remarks by stating that I am an ardent believer in resection. It is gratifying to see that those who are doing a large number of resections are voicing an opinion that should have been voiced and stressed at the very beginning of this work, namely, that resections are not to be done by anyone who has a casual idea of the bladder neck anatomy and pathology.

Dr. Sisk struck the keynote of resections when he spoke of fundamentals. This is an age of fundamentals. I agree most heartily with Dr. Braasch that the two most persistent and dangerous complications are hemorrhage and infection. In my hands, infection is more dangerous than a hemorrhage. When this work was first started, the cry was, "Look out for the hemorrhage!" We never heard of infection. The first fatal case I had died of infection. I did a postmortem and learned more about resections from that one patient than I have learned since.

Hemorrhage, in the vast majority of cases, can be controlled at the time the cut is made. One should never turn one's back on a hemorrhage, go on and do the resection, and then come back and attend to the hemorrhage, because the bladder will fill up, cause all kinds of trouble and at the end one will probably have a patient who has expired.

Too much coagulation, in my hands, has led to delayed hemorrhage and infection. In those cases in which a minimum amount of coagulation is employed, I have had little or no difficulty.

Dr. Thomas speaks of the enlarged prostates. Where are they? We still have them with us, and we probably always will have them. There is no reason in the world

why these individuals should not be drained suprapubically, the same as they always have been. These are the patients who undoubtedly have given us the vast majority of our trouble. They are the same patients who give us trouble in any form of prostatic surgery with their large, infected prostates. They are the patients who expire under resection the same as under prostatectomy.

Three years ago I made a preliminary report of a small number of cases, and I stated that resections would become bitterly criticized. I didn't know I was to prove a good prophet, and that the mortality would mount by leaps and bounds, and will continue to do so until resection is done only in properly indicated cases.

The type of current and the instruments one uses, is purely a personal matter. The principal thing is to use those that will traumatize the least.

Transurethral resections have done much to produce mortality in all types of prostatic obstruction. He who does prostatic work, regardless of the operation, is bound to have bitter disappointments, and transurethral resections are no exception to the rule. I have had all the complications I have read about, and a few I have-not read about, all the displeasures as well as the gratifying results connected with this procedure. If all this had been clearly stated at the beginning of this work to the profession at large, the procedure would be on a more firm basis than it is today. However, such was not the case. Therefore, the operation has suffered, but it has now taken its definite place and, with the succeeding improvements in instruments and currents in qualified hands will become a method of choice in indicated cases.

Dr. C. K. Smith (Kansas City, Mo.): Dr. Jones talked about the 100 per cent resectionists. I don't think there is any such man. Those of my acquaintance who profess to be 100 per cent resectionists, slip under cover and do prostatectomies once in a while. I think we all do.

I do think the country is becoming prostatic conscious, and patients are coming to inquire what can be done. I think that is where the resectionist comes into his own, because these men are inclined to accept resection, but wouldn't accept prostatectomy. One cannot compare the results of resection and prostatectomy offhand, because there are a very large number and a very goodly percentage of cases which accept resection which are definitely much better risks than the patients who are subjected to prostatectomy.

I don't believe there is anything in the realm of surgery in which the personal equation plays such a prominent part as it does in this discussion. If we will assume that the resectionist is a competent technician, to begin with, we can discuss the ifs and ands and pros and cons more intelligently. The personal equation plays a great part in the technic as does the instrument used. Dr. Braasch can take the instrument I couldn't do anything with and show us a very nice result in a very high percentage of good clinical results. I have used the Caulk punch diligently for ten or twelve years before we started resection, and I can do ten times as much with the McCarthy resectoscope as I ever could with the punch. I think the type of instrument used has a good deal to do with the reactions after resection. I quite agree with Dr. Braasch that that type of instrument can be used from which we can expect much less violent postoperative reaction. Otherwise, I should certainly feel Dr. Braasch had something I have never been able to discover when he can take fifty-five per cent of these patients and operate on them with impunity without any particular preparation.

The question has been brought up whether the patient needs any preparation, as for a prostatectomy. It indicates to me that Dr. Braasch is operating on a large percentage of cases that could undergo prostatectomies with impunity. So I don't think we can definitely compare resection with prostatectomy.

I do think, in view of the various opinions which have been brought out concerning infection and hemorrhage that there is nothing in the realm of surgery that requires more careful individual study preoperatively than do these cases, and I believe most of the complications could have been obviated if the patient was carefully put into condition. I think everyone approaching a prostate of rather large size would much prefer to have suprapubic drainage of some sort for a month, or two or three, before resection. In this resection propaganda we have a little bit oversold ourselves, the patients being sold on the idea of five days or a week in the hospital, through misinformation.

In the case of a patient with a large residual urine and perhaps infected urine it is foolhardy to fly in the face of Providence when we resect after four or five days' or a week's preparation. We are inviting trouble. That patient can be drained suprapubically, and if let alone until he has reached a tolerance stage he can be resected with impunity.

I have had the experience of having quite a number of cases come in from outlying districts, where the attendants have instituted suprapubic drainage three or four months before and the patients have large prostates and retention of urine. I have resected those cases immediately, and none of them has had more of a reaction than probably half a degree of rise of temperature.

We also noticed, in these cases where we had to do a second resection that reaction was absent. So we began to inquire, "Why do we have these reactions?" It seemed that in previous years, in doing prostatectomies we found an immense shrinkage of the prostate after suprapubic drainage of two or three weeks. There must be edematous swelling of the prostate which accounted for this. So we began

using a light cauterization of the prostate preliminarily, and we were rather agreeably surprised to see about ten days later, that these prostates were white instead of red, that the prostate had very materially shrunk, and on resecting them we were further agreeably surprised to see that we missed most of the rather violent reactions we had had.

In regard to the point Dr. Rolnick brought out, I have had the experience in earlier resections of having people come back and complain of burning and dysuria. Almost invariably, on cystoscopic inspection, we would see a protruding mass bulging from the side or down from the roof. We also found, on resecting these prostates which had previously shrunk, that these conditions were absent. The prostatic tissue was hard and firm, and when the bladder neck was molded with a resectoscope, it remained that way on subsequent cystoscopic inspection and our patients complained much less afterwards.

We began our experience of resecting these patients after suprapubic drainage last year at the General Hospital. We kept careful notes, and we did practically routine suprapubic punctures with a trocar. We compared our clinical postoperative course with the year before, and there wasn't any comparison whatever. It is a benign thing to do. The patient has practically no disturbance. In the large prostates we do the cauterizatoins at the same time as the vasectomy.

Postoperatively there is this advantage to a suprapubic drainage: You have a two-way safety valve, as has been brought out, and I think there is no question but that you get a remarkable shrinkage. A patient, if he has a highly infected urine, is depleted and has malnutrition, can be sent home, which we have done a good many times, for a month or two and then come back, when have no trouble whatever.

The question might arise: What about the suprapubic leakage afterward? Our experience has been that within twenty-four or forty-eight hours, these cystotomy wounds will come together if the obstruction is sufficiently removed.

In regard to the technic, I think if we expect to get a happy clinical result afterward we must leave a symmetrical bladder outlet, and not just go in and scrape a few pieces off the floor. I think one has to go around the bladder neck and leave a symmetrical outlet if one expects to get the best clinical result.

In the last six months we have been employing the idea of placing the finger in the rectum, and if we can feel a symmetrical bulging we resect that side until the prostatic field across is equalized and symmetrical.

Prostatic resection has come to stay. I think it is up to the urologists to meticulously perfect the technic and make a success of it. I can see one reason why Dr. Braasch has such a high percentage of happy post-operative results, and that is, I know, because he has an air-tight organization to take care of these patients afterward, which is one of the most important things. The surgeon who is going to turn his patient over to a general floor of nursing without some specialistically trained attendant, who will go and watch his patient every fifteen minutes, or every half hour or so, after the operation, would do much better to stick to prostatectomy.

Dr. Paul C. Rouls (Baltimore, Md.): It is a privilege to report on some work I had the privilege of seeing in Johns Hopkins in 1932 and '33.

Dr. Woods, attempting to find out why he was having difficulty with hemorrhage, and having available several types of equipment, made microscopic examinations of the prostatic material after it was removed. I was happy to assist him, and in the laboratory we found that some prostatic material under certain conditions of removal, the speed, the amount of energy used, was actually serrated and scalloped.

The primary weakness of any and all types of equipment is the fact that as long as they were using the commercial power supply (alternating) equipment, in the interval of time the loop was traversing the prostatic material it would tear it, necessitating going over the floor again. In some of the cases he worked on, in line with the comments of the last speaker, his method was not to take too much material at each traverse of the loop, but take a thinner shaving going around the entire erea, and then control the power so it was not necessary to go over the floor a second time.

I believe that if the manufacturers who furnish the equipment were forced to deliver a smooth, continuous modality that will cut and coagulate uniformly over the entire course of the traverse, it may answer some of the difficulties arising afterward.

Dr. A. D. Munger (Lincoln, Neb.): I am a relative newcomer in the ranks of transurethral resectionists. I began transurethral resections in 1932 through necessity of competition. Lincoln, Nebraska, is merely a suburb of Rochester, Minnesota, Kansas City and Omaha. In Omaha lives a perineal prostatectomist. In Rochester we have an ardent resectionist. Compelled to make a living, I went to Iowa City to my good friend Alcock and spent several days with him. He attempted to teach me transurethral resections.

In May, 1932, there appeared in the Nebraska State Medical Journal the following comment by Dr. Edwin Davis: "It seems doubtful whether, in the last analysis, the transurethral method . . . . offers the patient as great a degree of assurance of continued help and comfort as does perineal prostatectomy." Under this impression, after having completed a series of 274 resections by my associate and myself, the total number of resections of which were 316, I followed up these cases in order to answer Dr. Davis with regard to the late functional results. I sent to these patients the same questionnaire, which had a year previously been

sent to the perineal prostatectomy cases by Dr. Davis:

1. Do you feel that your bladder healed?
2. Can you control your urine?
3. Do you pass your urine too often?
4. How many times do you get up at night to urinate?
5. Do you pass your urine without difficulty?
6. As far as your operation is concerned, do you feel you are well, improved, or unimproved?

I present in brief the answers to these questionnaires. I sent out a series of 231 questionnaires, and up to October, 1934, I received 105 replies.

Before giving the results of this inquiry it is of interest to state that the anesthetics used were sacral and spinal. In the first 75 cases, 20 grams of tissue were removed. That, of course, does not represent the amount of tissue removed on the average in the later cases, which was much larger.

We had four cases with primary hemorrhage, which were all controlled. We had eight cases that had delayed hemorrhage. These delayed hemorrhages came on in from seven to twenty-one days. Ten cases had postoperative sepsis, due to improper or inadequate preparation, or some technical error following the operation. One case had a perivesical abscess definitely attributable to the resectionist who, in his zeal to resect that prostate, resected the trigone. A few days later there developed a perivesical abscess, followed by death. Miscellaneous complications were thrombophlebitis and pneumonia.

I mention these to show that transurethral resection is not the ordinary, simple procedure that the average physician or layman is apt to assume. It is a definite surgical procedure with the same difficulties and hazards as any other surgical procedure.

We had pulmonary infarct in one case. Five cases had serious heart disturbance after operation. Those patients were known to have heart affections. One case had extreme lethargy for three weeks, probably due to the spinal anesthetic. We also saw decubitus and septic ulcer.

Dr. Braasch presented his statistics on indwelling catheter, on which he quoted 55.3 per cent of operations without indwelling catheter. The indwelling catheter was in an average of five days. In our preoperative preparation we felt only 20 per cent of our cases could be operated without an indwelling catheter, while Dr. Braasch had 55.3 per cent. I am unable to understand the reason for that. If one does enucleation, certainly more than 55 per cent have to be prepared before operation. I feel our series in this procedure are just as large as with prostatectomy. We have to prepare more than 55 per cent.

Out of 231 cases 185 voided upon removal of the catheter postoperatively, difficult voiding was noted in 10; 36 were unable to void and had to be re-resected. Part of those were intentional, and part were unintentional. Average number of postoperative days in the hospital was 15, in contradistinction to resectionists who keep patients hospitalized four or five days.

Postoperative mortality involved 7 patients. Causes of death were: perivesical abscess—one, due to removal of too much tissue; hemorrhage—one, due to the patient having pulled the catheter out the morning following the resection and disappeared from the hospital. The next I heard from him was a long distance call from Kansas. The man was at home and bleeding severely, and he went on to death. There were two cases with known heart disease previous to operation, who died subsequent to operation. General sepsis; bilateral renal calculi in one case; pyelonephrosis in one case; diabetes with consequent uremic coma accounted for another case.

Number operated more than six months, 109; number operated six months or less, 41. I present this grouping because in the review of the questionnaires we found that patients do not reach maximum improvement until the end of six months. Those cases that reported on these questionnaires after six months were invariably good, in those who were adequately resected. Those who reported under six months' time were not so good.

We sent out 200 questionnaires and received replies to 150 prior to October, 1934.

We asked the first question: "Do you feel your bladder is healed?" The criterion for that was that we had received letters from some of the resected patients stating, "We are still passing considerable debris or pus in our urine," or the family physician would write, "The patient's urine is cloudy and is still having frequency of urination." We felt the patient's idea of the healed bladder was in direct accordance with the amount of pus or debris in his urine.

Of these patients to whom we sent the questionnaire, who had been resected for six months or over, 94 of the 150 felt their bladders were entirely healed. Fifty, who had been resected six months or over, stated they did not feel their bladders were healed, for the reason that they still had frequency of urination or there was some pus in their urine. Of those who had been resected under six months, 18 stated their bladders were healed, and 23 stated they did not feel their bladders were healed. In other words, a total of 112 out of 150 felt their bladders were healed at the end of six months, and 38 felt their bladders were not healed at the end of six months. Consequently, we felt six months must be the dividing line between complete healing of the bladder or maximum improvement in order to arrive at the proper conclusion.

The second question was: "Can you control your urine?"

It is quite definitely known that a definite per cent of perineal prostatectomies, as well as suprapubic prostatectomies want to know, following a prostatectomy or transurethral resection, "Will I be able

to control my urine?" So we felt this second question was essential.

In answer to it, 132 said they could adequately control their urine; 10 said no, and 8 were variable in their answers, meaning that if the weather was cold they had inability to control their urine, or sometimes at night they would find the bed wet, but for the most part they were able to control their urine.

"Do you pass your urine too often?" All of us know that a great many of these individuals, regardless of whether bladder neck obstruction is removed by suprapubic or perineal prostatectomy, or transurethral resection, will continue to have frequency of urination. Not because the frequency was actuated by bladder neck obstruction, but certain unrecoverable, degenerative kidney lesions.

Out of 150 patients 53 were passing their urine too often. Not a very good percentage. Nineteen said they did not pass urine too often, and six made variable comments.

"How many times do you get up at night to urinate?" It is quite proverbial, in taking a prostatic history, to go very meticulously into the patient's nocturia. They will get up from one to twelve or fifteen times at night, or every fifteen minutes. We wanted to know whether transurethral resection had improved that nocturia. Fifty-six of the 150 patients got up one or two times at night; 36 still continued to get up two to three times; and 35 continued to get up three or more times at night; 23 stated they did not have to get up at all. Every one of them had had nocturia from one to eighteen times at night, but they had no renal degeneration or else a more adequate resection. At any rate, we took the credit for it as resectionists.

"Do you pass your urine without difficulty?" After all, the man with the prostatic obstruction is chiefly concerned with his ability or inability to void. As long as the average case, that has to get up at night, can pass his urine he does not go to the family physician or urologist. It is when they cannot pass their urine, either from acute retention or extreme difficulty in passing their urine, that they seek relief. In my judgment, a criterion to a successful transurethral resection or a prostatectomy is the ease with which the patient can void postoperatively. Where the patient has had extreme difficulty, no matter how many times a night he gets up or how many times a day he voids that urine, and then can pass it without difficulty, without straining, and without pain, that man will feel he is adequately cared for and that the other situations are merely the result of old age.

Out of the 150 patients 137 could pass their urine without difficulty following resection. Thirteen said they still had some difficulty. There were no variables. Either they had difficulty in passing their urine, or they passed their urine normally.

We went into these thirteen cases quite carefully by letter or by personal contact, or by letter and personal contact, in order to determine the reason. Was it because of inadequate resection? Was it because of acne of the bladder? Was it because of some other pathologic condition in that patient's make-up?

I am frank to confess that in only four cases did we find there was a real reason for difficult urination. Mind, some of these 150 had had two resections. We only found four cases, of the thirteen we investigated, with a real reason for inadequacy in the passing of urine. Those we attempted to correct.

"As far as your operation is concerned, do you feel you are well, improved, or unimproved?" On that question, we wanted the patient's own unbiased statement.

Seventy-two cases that came in with definite prostatic obstruction of sufficient moment to merit a transurethral resection, said they were well so far as the operation was concerned, could pass their urine, and were perfectly satisfied. Seventy-four cases said they felt they needed no more resection work or prostatectomy, passed their urine, and were satisfied. Four cases were definitely unimproved, and those were cases that passed their urine with difficulty. In other words, 97.3 per cent out of 150 cases that were resected, from whom we received answers to the questionnaire, told us they were perfectly satisfied with the results.

Dr. Davis of Omaha, who does perineal prostatectomies, reported 98.1 per cent who stated they were well or improved.

If 97.3 per cent of cases will state, regardless of the type of prostatic benign obstruction and the size of the hypertrophy, they are sufficiently improved to be satisfied with their operation, then I believe resection has a very definite place in urologic surgery.

Dr. Ira R. Sisk (closing): There were one or two subjects brought up on which I would like to comment.

This subject will be controversial for many years to come. As the last discussant brought out, I think the individual factor plays a greater factor in this than any type of work the urologist is called upon to perform. I feel very confident that as the years pass many expert resectionists will develop and, on the other hand, many will give up in disgust and resort to other means of relieving these patients.

We, of course, have our troubles, and I think we always will have our troubles in doing prostatic resections. However, we have shown in our clinic that even with our prostatic resection and with a relatively low mortality for prostatic surgery, six per cent over eight years, we have been able to relieve these patients with a lower mortality, in less time, and with greater satisfaction to the patient than with prostatectomy.

The question of suprapubic cystostomy has been mentioned, and I would say that in our early work we performed suprapubic cystostomy in twenty to twenty-five per cent of the patients. In the last year or two we have gotten away from

it almost entirely. This is the result of development in technic.

In reviewing a series of 200 consecutive patients, on whom we performed prostatic resection, we find 45 per cent entered the hospital with complete retention of their urine. We do not hesitate, in these patients who have been catheterized elsewhere and whose urethras have been traumatized, to give fifty milligram injections into the spine in order to relax the tissues and catheterize. That is one of the improvements in the technic for resection. We use a low spinal injection with the patient in the sitting position and give a localized anesthesia which doesn't affect the legs, produces very little shock and very little change in the blood pressure. One can perform a prostatic resection on fifty milligrams, as I did the other day in a man over eighty years of age.

I do not think the matter of infection has been emphasized sufficiently, I mean infection introduced by the operator or his assistants following operation. In our work one of our outstanding improvements came about after our second hundred, when we improved our operating room and postoperative technic. At the present time, we use a technic which is the same as for any major operation, using regular operating room nurses, never permitting the operator to touch the skin of the patient at any time, and after operation the care is in the hands of those who review a limited number of people and are especially trained for it. A nurse with sterile gloves stands by the patient's side for two or three hours after the resection, until she is sure no blood clots are going to form in the bladder to interfere with drainage. If irrigation is necessary after that time, she is again required to wash the tube with alcohol, put on sterile gloves and carry out the proper procedure with the greatest care. By these means postoperative infection has been greatly reduced.

The size of the gland means nothing particularly to us. We do not carry out cystoscopic examination before the time of the resection. If the gland is huge, we work on one lobe at the first sitting, and leave the other lateral lobe for a second operation.

One other point is the question of the time element. I would like to point out that following prostatectomy the patient spends thirty days in the hospital. That is our average. He is so weakened he doesn't expect to do anything for a month or two after he gets home, consequently it is about three months from the time of the operation before he expects to be in condition to go back to work. On the other hand, the patient who is resected expects to return to work in a week or ten days after his operation, and then complains because he has a little irritation when he urinates. Of course he has irritation until complete healing takes place.

Lastly, I would like to mention three patients I have in mind who are in the hospital at the present time who have been resected in the last week, one last Saturday, and two last Monday, one eighty-four, one eighty-one, and one seventy-nine who recently recovered from a severe cardiac decompensation. These patients were resected without any difficulty. One of them is now ready to leave the hospital, except we are holding him for fear of hemorrhage. The others are in excellent condition, and those were all patients on whom, I am sure, everyone would perform prostatectomy with hesitation. The procedure which can be utilized in even a limited number of patients of that type, with so little loss of time, so little shock, possesses too great merit to be thrown into the discard. I am sure, therefore, that prostatic resection in the hands of some will, in the future, be used almost as a routine procedure.

Dr. W. F. Braasch (closing): The question which seemed to arise in many of the minds of those who discussed this subject, particularly the figures I showed, was the large number of patients, fifty-five per cent, who required no preliminary treatment to resection. It really is a very interesting subject.

There is no question that the literature and discussion of transurethral resection has educated the public to a tremendous degree in the last few years. They have become, as somebody suggested, prostate-minded. A large percentage of our patients come to us for this reason. They have noticed urinary difficulty in the last year or two and fearing they will have complications they come early in order to avoid these complications. It certainly is a compliment to the intelligence of the public, to the propaganda and also to the confidence they have in the urologist.

A great many of these patients, on examination, will have less than an ounce of residual urine, or possibly they will have one or two ounces of residual urine, seldom more than 100 c. c. in that group. They have a small amount of obstruction, in the majority of cases, and therefore they are easy cases, which accounts in a measure, probably, for the low mortality and the high degree of success which we have following resection. There is no question about that. I dare say our cases are much more favorable than the average urologist will see. They are certainly much more favorable than the cases Dr. Jones had brought to him with distended bladder and blood clots. There is no question that he is forced to do suprapubic cystostomy in those cases.

On the other hand, we will do transurethral resection where there is eight, ten or fifteen ounces of residual urine, which patients have normal blood urea and are in excellent condition. They don't require preliminary treatment.

Our idea of the gradual decompression of distended bladders has changed entirely in the last two or three years. Ten years ago we thought we ought to decompress gradually, but we have changed our minds completely on that group of cases. The main difficulty with overdistended bladders was the secondary infection we gave them, and not the bleeding from

congestion of the kidneys. So our ideas of preliminary treatment have changed very much. We have a large group, fifty-five per cent, who require no catheterization, including certain patients in whom we formerly used to put a catheter and now don't think it is necessary to do so.

Now that we have gone through our pioneering stage and have capable resectionists scattered pretty well over the country, I think there ought to be a law passed which would make it criminal for anybody to attempt to do a resection on a patient unless he has had experience on 100 to 200 patients, or has worked at the side of such an individual and become familiar over a period of years with the technic required for resection.

There ought to be a law passed making it a criminal offense for a salesman to try to sell a resectoscope to a man who has not had such an experience.

I recall seeing a patient a few weeks ago who had been resected by a man in a small town in Minnesota. He had treated venereal diseases and passed a stricture several times, and thought he ought to be able to do a resection. He wrote to a urologist, who had a resectoscope, and asked him to lend the resectoscope to him, that he had a patient to do it on. Much to my surprise, the urologist was unwise enough to lend his resectoscope to this individual, who did the resection, and we saw the patient several months afterward with both sphincters gone and a urethrorectal fistula. Certainly an experience of that kind is terrible and should be prevented by law.

There is no question that transurethral resection will be done more in the future to a larger percentage than it is even now. The public will undoubtedly demand it and should demand it. However, there is also room, I dare say, for a man who can do a prostatectomy with a very low mortality and good results, like Dr. Davis, to whom Dr. Munger referred. There is room for him as well. Nevertheless, the resectionist who is skillful and is able to get the best results will undoubtedly be the one who will get most of the work in the future.

Dr. Gilbert J. Thomas (closing): I want to emphasize one point that I think accounts for our difficulties, for our differences of opinion, and for the complications that arise after operation, and that is infection.

Dr. Braasch didn't tell you, but his cases are probably examined better than any of ours. They know what condition the patient is in. If we paid more attention to the number of pus cells in the urine and whether that could be removed easily or not, as telling us whether a drainage of the bladder should be used to assist in the control of that infection, that among all the patients we see with acute retention and much infection, we will find we will have to do suprapubic drainage in about ten per cent.

So I think the point to emphasize is not what instruments to use. As Dr. Braasch has emphasized, the problem is to know how to use it, that hemorrhage need not be a complication if you know how to use your instrument. But the complication that is present before the patient is operated, that bothers you when the patient is operated, and the complication that makes your result incomplete is infection. So if we use an instrument, have had experience, and watch infection, in addition of course to other complications, I think our results would be about the same, and I think the question as to whether we do resection in 100 per cent or suprapubic prostatectomy in ten will be determined on that basis.

Dr. H. C. Rolnick (closing): The purpose of presenting this paper was to eliminate the so-called good risks, entirely eliminate the minor types of obstruction.

The type of cases in which it seemed to me we ought to evaluate this particular method was in the poor risks; not in the very poor risks, but in the poor risks. I also maintain that the mortality rate, for statistical purposes, should not include those on whom there have been preliminary cystotomies. I don't think that tells the story of the valuation of the operation. Once you have done a preliminary cystotomy, it doesn't matter what you do thereafter, you have developed a safety valve. If we evaluate this procedure on the closed bladder alone, you will find a higher mortality than has been mentioned for these poor risks.

Another thing: It seems to me once you have had a preliminary cystotomy in men who have large prostates, men in whom you can enucleate the prostate very rapidly, there is little wisdom in doing a resection. Because of that, I still maintain there should not be any classification of men who are avowed resectionists and doing nothing else, or men who are avowed operators and doing nothing else.

Resection has a distinct place, and I do it more and more, but I think most of the men who have a moderate experience in urologic surgery and resection, you will find, will still be operating. Also, it seems to me, despite the fact that many of our patients are sold on resection, that should not be the criterion as to whether or not they should be resected. I have lost a number of patients whom I have refused to resect, and I am perfectly satisfied to have lost them. I felt I stood my ground.

Dr. Munger, a moment ago, clarified a thing that was in my mind. He told me he had sent out 231 questionnaires, and his response was from 150. I asked him as to the other 81 who did not respond. That, of course, would make a large degree of variation in the statistics. Often the patients who don't respond are the patients who have poor end results. He tells me, however, he has had responses from nearly all his patients, 210, and the general proportion is the same as that reported in the 150.

DIATHERMY IN DISEASES OF THE EYE *

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Diseases of the eye have been subjected to so many different forms of treatment that diathermy, to the casual observer, is but another remedy added to the already top-heavy list. The initiated on the other hand have the firm conviction that this new physical agency will reach a very important position in ophthalmologic practice.

There are many conditions, which, if removed by caustics or acids often leave unsightly scars; or, if removed by surgery always require a long routine of preparation, asepsis, deep anesthesia, post-operative dressings and care. As a subsequence, there may be certain glands or muscles whose functions have been more or less disturbed, with the further possibility of infection and scarring.

It is a source of satisfaction both to the patient and to the surgeon that new growths can be removed without extensive surgical preparation and operative procedures which are naturally difficult because of the delicate structure of the eye and its adnexa. Then, too, there are the after-dressings, eye-patches and bandages, which in most cases of removal by the surgical current may be eliminated. This alone is appreciated by the patient, for after all eye-patches and bandages are unsightly, incapacitate the eye and therefore subject the patient to a state of blindness during convalescence.

Another advantage is found in the fact that many patients do not have to be hospitalized, thereby effecting a big saving and assuring the surgeon of an early compensation for his service — not a small item in these times.

This paper will deal with both the surgical and medical forms of diathermy and with certain special types of electrodes especially devised for ophthalmological work. It will not review the various heat-producing waves, short waves and ultrashort waves, and unless otherwise stated the current referred to will be the short wave current, named "radiathermy" by Kobak.[1]

Numerous studies of the high frequency current have demonstrated that the various tissues of the body present different degrees of resistance as the current is passed through them. It has also been shown that as the frequency is increased, the resistance of these various structures in ohms is decreased.[2] This, therefore, gives a wider field of influence to the short wave current.

Moncrieff, Coulter and Holmquist,[3] through experimental work (on the dog) were able to produce an average maximum elevation in temperature in the various parts of the eye as follows: orbit, 4.49 degrees C.; vitreous, 6.98, anterior chamber, 6.54, conjunctiva, 7.11, all after a fifteen minutes exposure.

This is conclusive evidence in favor of medical diathermy which lays the foundation for its use in diseases of the eye where a local elevation of temperature is indicated to hasten elimination and repair.

Heat is a common home remedy prescribed by most oculists in the form of fomentations, hot-water bottle or electric pad. Medical diathermy furnishes the proper heat-producing current to effect a beneficial increase in temperature in the eye, orbit and deeper nerve tracts. Careful and proper application of the current[4] will effect a beneficial change in many conditions and diseases of the orbital contents, some of which we have tabulated.

Diathermy is divided into two types according to its action upon tissues: 1. General application of the current producing heat of a character to stimulate metabolism and the circulation of the blood and lymph, — called "medical dia-

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 10, 1935.

thermy" and 2. Localized application in a manner and strength to cause destruction of the tissue, called "surgical diathermy."

Apparatus. It is not essential to have elaborate apparatus. A good, short-wave-producing electric apparatus with a few well-selected electrodes for special use is all that is required. The frequency should be well above 10,000,000 cycles per second.

Electrodes. There are many good medical and surgical electrodes[5, 6] on the market. The surgical electrodes should not be too large, as some of the present designs seem to be. They should be carefully selected for the type of work for which they are to be used. Desiccation, fulguration, coagulation (superficial and deep) and dissection can all be accomplished with the same electrode especially designed for our particular use. For the medical ocular electrode there is still room for debate as to the proper size of the active electrode. The author prefers oval, flat electrodes, 2½ by 3 inches in diameter, for treatment to the orbital contents anterior to the optic disc and applied over the lids, and quadrilateral electrode, 2 by 3 inches, for treatment to the posterior orbital contents and the optic chiasm and surrounding tissue. It should be placed over the anterior temporal region.

Smaller surgical electrodes are preferred for special work, such as electrocoagulation of the choroid for detached retina, for which Walker,[7] Safar,[8] and others have special designs, as has Lacarreres,[9] for the removal of cataract[10] and dislocated lenses.

Control of the current for medical treatment is best accomplished by the ordinary switch, while the surgical current is best controlled by a foot switch.

Anesthesia can be produced by injecting a solution of novacain or any of its surrogates. Operation should not be started until most of the infiltrating edema and swelling has subsided.

The short wave high frequency current is not a panacea for all diseases and conditions of the eye, although the list of new growths which can be removed from the lids and anterior segment of the globe is large enough to make it appear so. Gala[11] reported six cases of carcinoma of the lids successfully treated with surgical diathermy and claims it caused a complete destruction of all malignant cells. Strobel[12] also used electrosurgery to remove malignant growths of the lids and globe and effected destruction of the lacrimal gland by electrocoagulation in cases of epiphoria. He also used the cutting current to perform posterior scleratomy in cases of glaucoma. Benedict[13] treated carcinoma of the limbus with electrosurgery. Weve[14] also successfully removed carcinomata and sarcomata from the lids and removed eyelashes, cysts of the small glands, and warts from the lids. He further claims to have been successful in the destruction of intraocular glioma, melinosarcoma and tuberculomata. Trachoma has been successfully treated by Coppez[15] and Rafain.[16] The latter prefers monopolar fulguration. Defong[17] treated acute and chronic dacrocystitis by utilizing the lacrimal probes as active electrodes.

Figdor[18] claims that medical diathermy has at least two actions, namely, heat and hyperemia. The former serves to relieve pain and the latter as a primary therapeutic factor. He found it beneficial in the relief of pain due to chronic eye diseases, such as iritis, iridocyclitis, episcleritis and glaucoma. One author[19] treated blepharoconjunctivitis and dendritic keratitis without beneficial results, but obtained good results with diathermy in cases of episcleritis and iridocyclitis.

The author prefers the coagulating current for the removal of the cilia in cases of trachiosis, as do Capero and Comas.[20] Moers[21] uses the cutting current in making an incision for the purpose of drainage in cases of orbital phlegmon, claiming two distinct advantages: 1. Due to the sealing of the blood and lymph channels, the infection cannot spread; 2. The action of the current produces

sterilization along the line of incision. Cottle[22] was successful in treating pannus with surgical diathermy while Clark[23] is very enthusiastic over the advantages of electrosurgery in the removal of neoplastic lesions of the orbit.

Zubak[24] removes pterygia by electrocoagulation. The growth is held up with a forceps while coagulation is being accomplished and eye-patches are used only in exceptional cases. The author has found medical diathermy to be the most efficient agent for the reduction of vitreous operations; others[25] have given good reports for the same condition.

Erlangers[26] treated muscular paralysis, retrobulbar neuritis, retinochoroiditis, chorioretinitis disseminate, retinal arteriosclerosis, and retinal diabetes with medical diathermy. He also stresses carefulness of the dosage. Two cases of post-neuritic atrophy have been reported improved by diathermy.

Loeffler and Wellish[28] treated glaucoma, retrobulbar neuritis, diseases of the retina and choroid, vitreous opacities and other diseases of the eye. Hollender and Cottle,[29] and Rycroft[30] use diathermy to reduce tension in glaucoma and the author has reduced tension as much as 12 mm. Hg. with one treatment. Garcia and Cespedes[31] have satisfactorily treated 210 cases during a period of 2½ years.

The current has been employed for the surgical removal of cataract and dislocated lenses by Lacarrere,[9] Costi,[32] Engelking,[33] Jess,[34] and the author.[10]

Surgical diathermy[35] in the form of coagulation has been accepted by oculists all over the world as the best agent for detachment of the retina. This important subject has been treated so extensively in the literature, that only mention of it will be made here.

Cordero,[36] after experimenting with electrocoagulation on rabbits' eyes, concluded that perforating coagulation is the safest method, while Salus'[37] results were so discouraging that he gave it up and states he will not use it again.

The author believes that the dangers of complications can be entirely eliminated by careful and painstaking application of the various currents. Berliner,[38] in giving large doses of diathermy to produce artificial hyperpyrexia over four to four and one-half hours, produced herpes of the cornea. The author believes the complication could not occur in the local treatment of eye diseases.

Federici[39] discourages the use of diathermy in eye diseases. He made microscopical examinations of corneal tissues from an eye which had been treated with diathermy and found corneal infiltration, and de-epithealization.

Following is a rather incomplete list of diseases and conditions of the eye which have been found favorably to respond to diathermy or radiathermy of various frequencies and wavelengths. Most of these have been treated by the author and have also been described in the literature.

TABLE 1. — *Diseases Amenable to Diathermy.*

Name of Disease	Type of Current
Lids	
Abscess[21]	Surgical (incision)
Ulcers	Surgical (coagulation)
Hordeolum	Surgical (incision)
Chalazion[14]	Surgical (coagulation)
Trichiosis[14-20]	Surgical (coagulation)
Entropion Spasticum	Surgical (multiple deep coagulation)
Ankyloblepharon	Surgical (incision)
Naevi (mole)	Surgical (coagulation)
Warts[14]	Surgical (coagulation-desiccation)
Xanthelasma[13-14]	Surgical (coagulation)
Cysts of gland of Mall[14]	Surgical (coagulation)
Angioma	Surgical (extirpation-cutting current)
Epithelioma	Surgical (coagulation and cutting current)
Carcinoma (early)[11-12-13-14]	Surgical (coagulation)
Carcinoma (advanced)[12-14]	Surgical (extirpation-cutting current)
Sarcoma[14-15]	Surgical (extirpation-cutting current)
Muscular paralysis[26]	Medical

TABLE 1. — *(Continued)*

Name of Disease	Type of Current
Lacrimal Apparatus	
Acute purulent dacrocystitis	Surgical (incision)
Acute and chronic catarrhal dacrocystitis[17]	Surgical (lacrimal probe for active electrode)
Epiphoria[12]	Surgical (coagulation of lacrimal gland)
Conjunctiva	
Follicular conjunctivitis[15-16]	Surgical (coagulation of the follicles)
Trachoma	Surgical (coagulation of trachoma bodies—fulguration)
Phlyctenular conjunctivitis	Surgical (desiccation)
Tubercules of conjunctiva	Surgical (coagulation)
Pterygium[24]	Surgical (coagulation)
Symblepharon	Surgical (cutting current)
Benign growths	Surgical (coagulation)
Malignant growths[13]	Surgical (coagulation and cutting current)
Ulcers of conjunctiva	Surgical (coagulation)
Pannus[22]	Surgical (coagulation) Special electrode
Episcleritis[18-19]	Medical
Catarrhal conjunctivitis	Medical
Cornea	
Ulcers	Surgical (fulguration)
Opacities[25]	Medical
Phlyctenulosis	Surgical (desiccation)
Uveal Tract	
Iridocyclitis[15-18]	Medical
Diseases of the choroid[25-26]	Medical
Crystalline Lens	
Cataract[9-10]	Surgical (coagulation)
Dislocated lens[33-34]	Surgical (coagulation)
Subluxation of lens[32]	Surgical (coagulation)
Vitreous	
Muscae volitantes[28]	Medical
Synchysis scintillans[25]	Medical
Inflammatory opacities[28]	Medical
Traumatic opacities	Medical
Retina	
Retinitis[28]	Medical
Retinochoroiditis[26]	Medical
Chorioretinitis disseminata	Medical
Retinal arteriosclerosis[26]	Medical
Retinitis diabetica[26]	Medical
Retinal detachment[35-36-37]	Surgical (coagulation)
Optic Nerve	
Retrobulbar optic neuritis[7-26]	Medical
Posterior neuritic atrophy[27]	Medical
Miscellaneous	
Neoplastic orbital lesions[28-29-35]	Surgical (cutting current)
Glaucoma	Medical
Posterior scleratomy for glaucoma[12]	Surgical (coagulation)
Orbital phlegmon[21]	Surgical (cutting current)
Muscular paralysis[26]	Medical

Conclusion

There are 19 diseases and conditions of the eye and its adnexa which respond to medical diathermy, 38 in which surgical diathermy is indicated.

Surgical diathermy or radiathermy eliminates the long routine of asepsis, oftentimes extensive anesthesia, patches and bandages, sutures, surgical after-care and sometimes hospitalization.

Medical diathermy or radiathermy elevates the temperature in obscure parts

of the globe and orbit, making it useful in cases where rapid elimination and repair are needed.

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231 W. Washington St.

Propose an Institute of Industrial Medicine

A national institute of industrial medicine to protect the health of American workers was proposed to the American Public Health Association by Dr. Henry H. Kessler, medical director of the New Jersey Rehabilitation Commission. The working group must not be looked on as a special class, Dr. Kessler said, for today it forms the larger part of our entire population, and since the mechanization of agriculture includes the farmers of the country. The average worker lives six or eight years less than the average member of the population, Dr. Kessler pointed out in calling attention to the need for special means of protecting this important class.

The institute, as Dr. Kessler outlined it, would have a four-fold function. It would promote research in industrial diseases. It would sponsor a campaign to teach the worker how to protect his own health. It would sponsor legislation for the protection of the worker and develop standards of industrial health.

An important function of such an institute would be the creation of a panel of qualified medical and non-medical experts who could be called on in litigation over industrial diseases, compensation cases, and the like, thus correcting the present abuses in law cases involving occupational disease.

The proposed national institute of industrial medicine is in line with the present trend of governments assuming more and more responsibility for the protection of life and health of individual citizens, Dr. Kessler pointed out.

The two chief occupational diseases, he said, are silicosis in the dusty trades, and skin diseases from exposure to irritating chemicals in various industries. — *Science News Letter.*

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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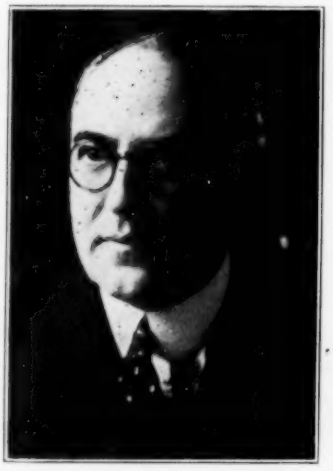
EDITORIALS

William Lawrence Clark (1876-1936)



WILLIAM LAWRENCE CLARK
1876-1936

It is with profound sorrow that we chronicle the passing of Dr. William L. Clark of Philadelphia, on January 12th, President of the American Congress of Physical Therapy for the year 1934-1935. With his demise, physical medicine and electrosurgery lose a laborer of outstanding ability and enthusiasm for the domain in which he became master. To all members of the Congress who have had the privilege and the pleasure of coming in contact with him, not only as a scientist but as a colleague and fellow citizen, his departure from this life will mean an irreparable loss. The Officers of the Congress and the Editor of the ARCHIVES who have enjoyed his hearty cooperation and devoted friendship for a number of years, join with countless friends and patients in expressing to his family their profound sympathy in this, their hour of bereavement, and to offer as a solace the realization that his life has been one full of compassion for suffering humanity and that he was ever ready to give the best that was in him to all who sought his professional aid. Such labors have not been in vain and have left a memory of achievement glorious to visualize.

William L. Clark was born at Honesdale, Wayne County, Pennsylvania, July 30, 1876, son of Mr. and Mrs. Edward C. Clark. He was a descendant of an old Colonial family.

His early education was obtained in the Honesdale schools, where he taught for several years after his graduation. Pursuing his ambition to study medicine, he entered Niagara University, and later matriculated at the University of Pennsylvania Medical School, from which he received his medical degree in 1903. His interneship was served at St. Joseph's Hospital, following which he entered private practice.

Several years later, he developed a very severe sacro-iliac arthritis which confined him to bed for about a year. When able to travel, he went to Hot Springs, Virginia, where he met Dr. E. C. Titus of New York City, one of the pioneers of physical therapy. On his return, he visited Dr. Titus who relieved by physical therapy, his serious condition. His interest aroused by this personal experience, he began the study of physical agents in medicine.

In those days, the high frequency current was produced by a static machine with Leyden jars and a resonator. The electro-desiccating effect produced by this current was first recognized by him in 1908 and described before the American Electrotherapeutic Association, in Saratoga Springs, N. Y., in 1910. From that time on, he worked unceasingly in the development of the application of the current to benign and malignant neoplasms.

He was a prolific writer and presented numerous papers on electrothermic methods in surgery. Anxious to impart to physicians the technic, he was never happier than when demonstrating it to a group of colleagues. To Dr. Clark goes the universally acknowledged priority for the term, electrodesiccation. His contributions to medical literature have appeared in the foremost medical journals throughout the world. He contributed a chapter on electrosurgery to Dr. Costa's text book on surgery; one to the "Principles and Practice of Physical Therapy," by Mock; and one to the "System of Surgery," by W. W. Keen.

In 1923 he opened a private hospital in Philadelphia for the treatment of malignant disease. A pioneer in the application of radium and x-ray, he was one of the first to use the fractional technic, and never departed from this even in the days when massive doses of x-rays came into vogue.

He was one of the leaders in physical medicine and surgery, and honored with the presidency of the American Physical Therapy Association, American Congress of Physical Therapy and the American Academy of Physical Medicine. In 1933, he was awarded the Gold Key of Merit of the American Congress of Physical Therapy, and the honorary degree of Fellow of the American Academy of Physical Medicine. He was a Fellow of the American Medical Association, a member of the Pennsylvania State Medical Society, Philadelphia County Medical Society, Philadelphia Medical Club, American Radium Society, American Roentgen Ray Society, Radiological Society of North America, and Philadelphia Dermatological Society.

He was at one time on the staff of the St. Agnes, St. Mary's and Jefferson Hospitals. He was lecturer on physical therapy at Jefferson Medical College for a number of years.

Dr. Clark is survived by his widow, Mary McMahon Clark and by four sons, David, William L., Jr., Edward, and Robert and two daughters, Nancy and Margaret.

A great healer has gone to his merited rest.

HISTOPATHOLOGIC STUDIES OF NASAL ZINC IONIZATION

Efforts to rationalize zinc ionization of the nasal mucosa for palliation in allergic conditions has led to some noteworthy researches. McMahon[1] conducted studies on the mucosa of the frontal sinuses of dogs and concluded that definite destructive changes were brought about by the ionization of zinc sulphate in the

sinuses. These changes consisted of ballooning, fragmentation and complete destruction of the surface epithelium in most places, and marked edema and partial disintegration of the subepithelial tissues and extravasation of free red blood cells into the tissues, produced by dilated and ruptured capillaries. As a result of these immediate extensive changes McMahon felt that in the process of regeneration of the mucosa more extensive and permanent changes might be brought about, and it was with the idea of studying possible progressive changes that further experiments were undertaken.

In summarizing his further studies, McMahon[2] stated:

> A study has been made of the effects on the mucosa of the nose and frontal sinuses of dogs following ionization, the immediate widespread destructive changes and the readjustment of these delicate tissues characterized by a progressive accumulation of connective tissue in the tunica propria as evidenced in dogs killed eighteen hours, two weeks, four weeks, seven weeks and twelve weeks, respectively, after ionization. The changes observed in the mucosa and bone of the frontal sinus are further corroboration of the reaction of such tissues to extreme irritation.

Hollender and Gorin[3] performed biopsies of the inferior turbinate of humans and commented on the histopathology as follows:

> All untreated controls are virtually identical in their histopathology. The sections taken immediately after ionization show changes in the surface epithelium ranging from thickening to partial destruction. The absence of cilia is characteristic in sections made after ionization. The mucous glands had undergone no change.
>
> Sections taken at various periods subsequent to ionization showed a gradual regeneration of the surface epithelium, first as a squamous cell formation and within three months as a pseudostratified type, with the cilia persistently absent. The subepithelial stroma showed a gradual tendency to become more dense in the structure with an early marked lymphocytic reaction, subsiding slowly, but persisting to some degree even a number of years after treatment. The mucous glands showed no changes in all sections but one.

In these studies, save for the persistent absence of cilia, the observations correspond in the main with those of McMahon. This investigator raises the question: "Should generalized fibrosis of the nasal mucosa be considered as an optimum state for the proper functioning of that mucosa?" He believes there is ample reason to fear that within a comparatively short time a condition would be brought about which might aptly be termed a premature nasopause.

Such reasoning is not borne out by clinical experience, for patients observed several years after ionization by Hollender and others, had not suffered from "nasal pains, hyperesthesia, neuritis and headache of a more or less intractable nature," as pronounced by McMahon. Furthermore, it should be stated, that if the latter's reasoning is sound, thousands of individuals would now have to be classed as "nasal invalids." Similar mucosal changes have resulted from chemical and actual cauterization, which for decades has been recognized as competent therapy.

Irrespective of the controversy which these researches have brought about, the rhinologist can properly evaluate ionization by individual experiences. Certainly there is no ample proof that ionization is a harmful procedure. The conjectures are not in accord with critical clinical observations.

While the subject is still in a controversial state, there have been opened up many new avenues for further study. Until the significance of the persistently absent cilia can be explained, one is justified in proceeding cautiously. If it is a fact, as has been observed in numerous instances, that clinically no harm has resulted, our entire concept regarding the physiology of the nose may require revision.

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THE FIFTEENTH ANNUAL SESSION

Announcement is made of the fifteenth annual scientific and clinical session of the Congress to be held at The Waldorf-Astoria, New York City, September 7, 8, 9, 10, 11, 1936.

This promises to be one of the noteworthy medical gatherings of the year. With the increasing interest in physical therapy and the fact that the East has always contributed largely in attendance and to the scientific program, there is little question that the fifteenth annual convention will surpass all previous ones.

While each year many new features are injected in the program, plans are under way to make this year's exceptionally outstanding. No instruction classes will be held as New York has ample schools for teaching physical therapy. There will, however, be various other means of imparting information both from research and clinical standpoints.

With the cooperation of the New York Physical Therapy Society, local teaching institutions and clinics, every facility will be afforded for a session which should long be remembered in the history of the Congress.

THE ARCHIVES IN NEW DRESS

With this issue the ARCHIVES appears in a new dress. The progress in building up both the membership of the Congress and the circulation of its official journal has made possible various improvements in the mechanical make-up.

The editors and the publication committee have constantly made every effort to present a periodical which possessed the utmost in scientific contents. It has been their desire also to give the readers of the ARCHIVES a journal of which they could justly be proud from the standpoint of appearance. While these goals are seldom fully attained, the approach to them in this instance is sufficiently close to be noteworthy.

It is indeed appropriate at this time to express the appreciation of the governing body of the Congress, and of the ARCHIVES in particular, to the many hundreds of physicians who have become permanent subscribers and who have made possible numerous valuable changes. There will be additional improvements as conditions warrant, and from all indications, in another year, the journal will be substantially increased in the number of its pages.

Special Article

PROGRESS OF PHYSICAL THERAPY *

JOHN S. HIBBEN, M.D.

PASADENA, CALIF.

In accepting the honor to serve as presiding officer of the Congress for the ensuing year, I am mindful of the responsibility which the office involves. I can only assure you that the Congress will find in me a zealous officer whose enthusiasm for, and devotion to our cause will not be diminished during my term. The heritage which falls to me is a heavy one. The chair I am about to take has been occupied by gentlemen of high scholastic attainments, who have aided in raising Physical Therapy to the high scientific standard it now holds in the domains of medicine and surgery. But what is of perhaps of equal importance is that my predecessors have given proof that success is inseparable from service.

This acknowledgment suggests the practicability of briefly reviewing the struggles and experiences of the past in order to better visualize what we may anticipate in the future. In reviewing the progress of Physical Therapy it is well to bear in mind that there would be no present, nor a future, were it not for the tireless and fearless efforts of the early workers in our field of endeavor. The path is now well illuminated with many beacon lights of scientific accomplishments, to enable us to carry on under favorable conditions.

We must go forward. There is no standing still in a world where all is motion, and what benefits one will benefit all. It should not be overlooked that virtually every new advance in therapy has passed three stages so far as acceptance by the medical profession as a body is concerned. The first stage was characterized by a general denial on the part of orthodox medicine. As the virtues of each particular addition to therapy forced recognition in spite of this negation, we trace in medical history a second stage of critical analysis. For meritorious contributions this stage always did, as it always will, terminate into the ultimate stage of general acceptance and purposive application.

In a world harshly critical, truth will assert itself by logic and fact. Criticism should not be feared but met. We owe it to their firm conviction in the efficacy of Physical Therapy and to their fearlessness and persistence that men like Tyler, Fouts, Kobak, Hollender, and others, have brought this Congress into being and have created traditions which assure permanence to this institution. In 1924, the American Medical Association organized a Council on Physical Therapy. In this select body we have impartial workers whose mission it is not at all to dampen enthusiasm, but to subject every moot problem, every new advance to the crucible of critical investigation, and this without fear or favor. The interrelation of the Congress to the Council on Physical Therapy has brought about a new scientific era in physical medicine. Overenthusiasm is led through the channels of experimental and clinical research to sift the apparent from the real, the fleeting from the durable, the theoretic from the clinical.

The Congress as a body politic has in addition to its purely scientific aims also material purposes calculated to improve our present precarious economic situation. We as individual members, must eliminate the tendency to complain of conditions as they have been, or even as they are, because, essentially, it rests with us to change these conditions and make them what we should like them to be. Let us concentrate on things we want. Momentary enthusiasm is of little value. It is only by unbounded self confidence and well-directed perseverance that a high goal can be reached. We must BE before we DO, and we can DO only to the extent we ARE. What we are depends upon what we think. We must have the determination to leave the beaten path in a realiza-

* Presidential Address, Fourteenth Annual Session American Congress of Physical Therapy, Kansas City, Missouri, September 9, 1935.

tion that extraordinary results are obtainable only by extraordinary means.

My own observation has shown that about 75 per cent of the medical profession looked upon Physical Therapy as something like a cult, irregular and unscientific. They seemed to regard it as competitive to regular medicine. The very mention of the term "Physical Therapy" to the majority of physicians evoked a mental picture of a room full of colored lights and expensive apparatus. They thought in terms of machine therapy.

Because of the cultivated indifference with which the profession has regarded every problem of Physical Therapy, there have arisen cults, whose practices center around distorted fragments of therapeutic doctrine. Many evils have resulted from the practices of these cults, due to the inability, or the refusal of orthodox medicine to make use of properly coördinated and controlled physical therapeutic measures. Add to this the general concept of physical therapy as a specialty, and we have a bar to getting the rank and file of the medical profession to accept it. It is clear that ethical physicians must be constantly reminded that Physical Medicine represents a scientific part of our legitimate therapeutic armamentarium. I do not mean to imply that there should be no specialists, because I realize that specialization in any branch of therapy is essential to insure scientific attainments and advance. It is as astonishing as it is disheartening, that countless well meaning and conscientious general practitioners when approached on any one problem of Physical Medicine will evade discussion on the ground that they do not practice physical therapy. The fact is that to a certain extent at least they all do. It should require no other reminder than the measures daily employed in the therapy of injuries, certain constitutional diseases, localized inflammatory processes, and the like, to cause them to realize that resort to supports, light, rest, sunshine, artificial radiation, radium or x-rays means the practice of Physical Therapy.

If the statistics compiled by Aspinwall are correct, I can think of no greater danger signal for the members of the medical profession who fail to recognize the value of Physical Therapy than the following data: One group of irregular practitioners, not a serious competitor a few years ago, now collects $42,000,000 per year. This income which once went to the general practitioner now is collected by 8,000 of this group. Another group collects each year about $63,000,000 which formerly went to the neighborhood physicians. There are also about 3,000 in another group who are denied resort to surgery and pharmacotherapy, and by lines of least resistance are forced to practice physical therapy. The thought suggests itself that the regular medical profession has been too greatly influenced by the claims made for so-called scientific innovations in the fields of pharmacy, endocrinology and bacteriology, and have stressed medication, grandular therapy and the administration of vaccines, sera and bacterins as assumed specifics for ills in the treatment of which established physical measures could have enhanced the results.

There is no escaping the fact that so-called quacks and irregulars licensed by the state to practice the methods we ignore, acquire an annual income of $105,000,000. Does this alone not show the need for us to investigate these methods; to evaluate them clinically by scientific application, rather than to condemn them solely because they happen to be exploited by unethical practitioners of quasi-medicine?

Recent readjustment of the social, economic, political and industrial status of our people has affected the regular medical profession. California to cite an example, has the greatest percentage of physicians to population of any state or of any nation in the world. In 1933, the greater proportion of the California medical profession earned less than $2,000, a lesser group $3,000, and the least $5,000. We can greatly brighten this gloomy picture by attracting a larger clientele through the effective employment of Physical Therapy. The discriminating public will be quick to realize that it is advantageous to consult physicians who have extended their diagnostic and therapeutic resources to include the domain of scientific Physical Medicine.

Let us now look into the future. Physical Therapy should properly be renamed "Physical Medicine," as this term better expresses its scope and dignity. The physician who prescribes or uses physical measures no longer needs to apologize to the public or to those members of the profession who, have been

"down" on Physical Therapy because they were not "up" on it.

I vision the regular profession not only properly oriented in the value but also in the limitations of Physical Therapy. Every hospital and clinic should have a regular physician trained in Physical Therapy, devoting his entire time to this specialty. He should be assisted by technicians who have been trained in institutions approved by the Council on Physical Therapy. Small groups of physicians and even individual physicians now practice Physical Therapy in their offices, with registered technicians. Judging from the present trend the physician in the future will know how to prescribe such treatment, because every medical school in the country will give systematic courses in Physical Therapy.

There are no lay establishments to which physicians have to refer their patients. "Parlors" and "establishments" have become far and few between, because of the greater interest of the medical profession in physical medicine. The American Congress of Physical Therapy holds annual sessions and publishes a scientific journal recognized here and in Europe as the most authoritative publication in this field in the English speaking language What a change there has taken place in this organization! Membership consists of fellows and associate members organized along lines of greatest scientific bodies. Membership is available to qualified members of the organized profession. At the annual meetings of this Congress we see then as even now — clinicians of high scholastic attainment on our programs. They come from this country and from abroad. This is added proof of the increased interest in Physical Therapy. The medical profession has finally been aroused from its lethargy. It is gradually being realized that interest in Physical Therapy will do much to bring back many of the patients who have been forced to seek relief in questionable quarters.

Sectional meetings continue to be held in four parts of the country giving opportunity to the members of the local profession to evaluate physical medicine. Every state medical society has appointed a special committee on Physical Therapy. Scientific contributions are increasing in number, not only at national, but also at state, county and local meetings. Even hospital staffs are now frequently discussing physical medicine. The *Journal of the American Medical Association* has an increasing number of articles on Physical Therapy. Constant sounding of warnings by authoritative bodies has discouraged the indiscriminate use of physical agents by beauty culturists and others of their ilk, and has encouraged consultations with physicians before resort to even ultraviolet radiation, which before, was used as freely as a drink of water.

Short wave therapy and general fever therapy are important additions to physical medicine. To be sure the last word has not been spoken on these new modalities, but we have already sufficient proof of their effectiveness in a number of affections that have in the past been regarded as the most stubbornly resistant to all known therapeutic measures. Here we have a vast field of research and clinical application which, we feel confident, will not only relieve countless sufferers from painful and disabling affections, but restore many who have been regarded as lost to society back to lives of usefulness.

Colonic therapy too, is now standardized as to indication, apparatus and technic and merits greater employment than was the case in the past. Radium rental, a once dangerous practice, is now available only to experts, skilled in its use.

In localities with a climate conducive to health one sees more doctors, regular and irregular; a floating population with a high morbidity rate and more hypochondriacs and semi-psychopaths, cared for chiefly by irregulars, because they offer to these unfortunates something regular physicians have ignored. As a consequence, the irregulars are enriched at the expense of the regulars. The regular profession is groping for some form of readjustment in order to be of greater service to this large and floating group of patients. Is it not significant that the irregulars continue to prosper? The Congress is doing all in human power to overcome the indifference of the regular profession to Physical Therapy in order to enable its members to win in the unequal struggle with prejudice, ignorance and dishonesty.

My friend, James Foley, Poet Laureate of Pasadena, has expressed my thoughts in verse which I present to you as a conclusion:

Wisdom comes down to us through the years,
Its steps are sure if its progress slow,
It follows the way of the pioneers,
The trail to now from the long ago.
And Wisdom is ever beset with foes,
Now and has been through ages past,
But Wisdom conquers for Wisdom knows
The truth shall come to its own at last.

The timid fear and the scoffers cry,
And the doubter throws up his barricade,
But Wisdom ever has passed them by,
And on its goal and unafraid.

And never the doubter shall long endure,
And never the timid for long shall stand,
For truth is mighty and truth is sure,
And truth is the keen blade in Wisdom's hand.

And we who would ease pain and dry the tears
Of grief and lift up the burdens laid,
We follow the trail of the pioneers
Who blazed the way and were not dismayed.
Let the timid fear and the scoffers cry,
And the doubter throw up his barricade,
We will lift the banners of Wisdom high
And know the truth and be not afraid.

SECTIONAL MEETINGS

AMERICAN CONGRESS OF PHYSICAL THERAPY
1936

MARCH 4 AND 5 — MID-WESTERN SECTION

Mayo Clinic — Rochester, Minn.

MARCH 23 — SOUTHERN SECTION

New Orleans, La.

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No Registration Fee

Physicians and technicians are invited to attend these sectional meetings. Programs may be secured by writing to

American Congress of Physical Therapy
30 North Michigan Avenue
Chicago

Dr. Frank H. Krusen
Mayo Clinic
Rochester, Minn.

Dr. N. H. Polmer
Maison Blanche Bldg.
New Orleans, La.

SCIENCE, NEWS, COMMENTS

Pacific Physical Therapy Association Meeting

The regular December meeting of the Pacific Physical Therapy Association was held December 16, 1935, in the nature of an All-Japanese Dinner at the Kawafuhu Cafe, Los Angeles. Dr. *Sidney Kibby* acted as Toastmaster, and introduced *Ajika Amano,* M.D., President of Staff of the Japanese Hospital; *Fusa T. Nakaya,* M.D., also a staff member; Mr. *Shunga Abe,* who gave an explanation of Japanese science of athletics. The guests later adjourned to the Judo Club, where an exhibition was presented of "Judo" (jujitsu).

Dr. A. Bern Hirsh Honored

The New York Physical Society tendered a dinner in honor of Dr. A. Bern Hirsh in recognition for his pioneer labors in the cause of physical therapy. The dinner was held at the Phi Gamma Delta Club in New York on Wednesday, January 8. The Congress and his friends know and appreciate Dr. Hirsh's sacrificing labors and vicariously participated in the festive spirit of the occasion and extend to him sincere wishes for continued health and happiness.

The Sixth International Congress of Physical Medicine — 1936

It has been decided to hold the Sixth International Congress of Physical Medicine in London from May 12th — 16th, 1936.

The first International Congress was held in 1905 at Liége. Professor A. von Winiwarter was the President and Professors L. de Munter and I. Gunzburg were the honorary secretaries. At this Congress 600 doctors assembled, representing 17 different countries and definitely gave their support to physiotherapy. Two years later, in 1907, a second International Congress was held in Rome and was organized by Professor Colombo. Professor Guido Baccelli was President.

The third Congress was held in Paris in 1910 and 27 different countries were represented. The Congress was opened by the President of the French Republic, M. Fallieres. It was held under the Presidency of Professor Landouzy. Professor Vaquez was the honorary secretary.

The fourth Congress was held in Berlin in 1913. Professors His and Brieger were the Presidents and the honorary secretary was Dr. Himmelmann.

After the Great War efforts were made to reunite the International Congress, and small Congresses were held in Antwerp and elsewhere, until the fifth International Congress was organized at Liége in 1930. Professor I. Gunzburg was President, Professor L. de Munter gave his patronage, and the honorary secretary was Dr. Dubois-Trepagne. Over 600 members, representing 30 different countries, attended.

At the end of this Congress at Liege an International Committee was appointed to organize the Congress of the future. This Congress has now been definitely fixed to take place in London, and Lord Horder has kindly accepted the office of President.

Since 1930 physical medicine has made great progress and there have been many new developments. The teaching of physical medicine has been introduced by some universities and examining bodies as a compulsory subject in the medical curriculum. As a general guide the subjects for discussion may be classified under three groups:

1. *The physiological and biological study of physical agents, especially those which are of recent discovery and invention.*
2. *The clinical indications of the different methods of physical treatment and the benefits and proper use of exercise in the healthy.*
3. *A comparative inquiry into the teaching of physical medicine in the different countries.*

The Congress will be in session for five days and a definite programme of papers of general interest will be organized for discussion, which will be published in the near future.

The Congress has been subdivided into six sections :

1. *Kinesitherapy.*
2. *Physical Education.*
3. *Hydrotherapy and Climatotherapy.*
4. *Electrotherapy.*
5. *Actinotherapy.*
6. *Radiotherapy and Radium Therapy.*

At the morning session addresses will be given on a subject of general interest to all members of the Congress.

It will be noted that the organization has added a section which deals with physical education from its widest and most comprehensive aspects.

Other discussions will include (1) Short wave high frequency electrical currents; (2) The production of pyrexia by physical methods; (3) Sun bathing for the healthy and in the treatment of disease; and (4) Remedial exercises in the treatment of the sick.

There will be an exhibition of electro-medical apparatus. The official programme of the Congress will be given in greater detail at a future date.

Dr. Richard Kovács Addresses Medical Society

Dr. Richard Kovacs addressed the Medical Society of the County of New York, Monday, December 16, 1935, on "Thermal Therapy in Chronic Disease." Among those who discussed this and other papers was Dr. Norman E. Titus.

Radiological Review and Mississippi Valley Medical Journal

The Radiological Review and Chicago Medical Recorder, published at Quincy, Illinois, since 1924, will change its name beginning in January and become the *Radiological Review and Mississippi Valley Medical Journal,* the official publication of the recently formed Mississippi Valley Medical Society. The editorial policies will be the same as the old *Radiological Review* with the addition of the publication of the papers read before the Mississippi Valley Medical Society. Dr. Harold Swanberg, the Secretary-Treasurer of the Mississippi Valley Medical Society and Editor of the old *Journal,* will remain as Editor. The Editorial Board of the *Radiologic Review* will be supplemented by an Editorial Board from the membership of the Mississippi Valley Medical Society comprising the following:

Isaac A. Abt, M.D., Chicago, Illinois.
Karl A. Meyer, M.D., Chicago, Illinois.
M. Pinson Neal, M.D., Columbia, Missouri.
Quitman U. Newell, M.D., St. Louis, Missouri.
F. Farm Norbury, M.D., Jacksonville, Illinois.
Walter Stevenson, M.D., Quincy, Illinois.
Dan G. Stine, M.D., Columbia, Missouri.
Meyer Wiener, M.D., St. Louis, Missouri.

The new publication will be published by the Radiologic Review Publishing Company, at Quincy, Illinois.

Glands and Emotions Seen As Factors in Epileptic Attacks

A glandular basis for fits or convulsions such as those occurring in epilepsy and possibility of treating the disease by gland extracts in the future were suggested at the meeting of the American Psychiatric Association. Emotional upsets were also blamed for causing epileptic attacks and good results from psychiatric treatment in such cases and from dietetic treatment of other cases were reported.

The role the glands, particularly the pituitary gland, may play in epilepsy was discussed by Dr. Albert W. Pigott of the New Jersey State Village for Epileptics. Dr. Pigott reported two cases of diabetes occurring in epileptics, a rare occurrence. In records of over eighteen thousand epileptics Dr. Pigott found only thirteen cases of diabetes.

The two conditions are in a way contradictory and Dr. Pigott pointed out that the fundamental mechanisms in the two diseases are antagonistic. Epilepsy, it seems, may be thought of as anti-diabetes. Diabetes is characterized by too much sugar in the blood and diminution of water in the body. In epilepsy there is an accumulation of fluid in the body. During convulsions, furthermore, epileptic patients have less sugar in their blood than in the period between convulsions, Dr. Pigott found. This fits in with the fact that convulsions are a feature of insulin shock, which occurs when a diabetic patient gets more insulin than his body requires to burn the amount of sugar and starch that has been eaten.

The pituitary gland is now known to produce a hormone that can bring on the diabetic state of too much sugar in the blood and it also plays an important part in regulating the body's use of water. Dr. Pigott suggested that a decrease in the diabetes-producing hormone of the pituitary may play a role in some cases of convulsions due to deficiency of sugar in the blood. He recalled that Dr. Harvey Cushing, of Yale University, was able to prevent convulsions in some epileptics by giving them pituitary gland substances. In one of the cases of diabetes complicating epilepsy described by Dr. Pigott, the average number of convulsions was reduced from twelve or thirteen a month to four or five after diabetes had developed.

"It is probable that with a fuller understanding of the endocrines and their interrelationship the problem will be more thoroughly understood," he concluded. — *Science News Letter.*

Crossed Legs Give Test for Disease of Blood Vessels

Your heart and your foot move to the same rhythm when you sit with your legs crossed. This natural, almost invisible, swing of the foot has suggested to a Baltimore physician a new test for disease of the blood vessels of the legs. A preliminary report of the new test, devised by Dr. Bertram M. Bernheim of Johns Hopkins Medical School, appeared in the *Journal of the American Medical Association* (March 23).

Dr. Bernheim attaches a short rod to the side of the shoe of the free leg. The pointed tip of this rod rests lightly against the revolving drum of an instrument that traces the swing of the leg. The less the swing, the more serious is the condition, according to his interpretation. The greater and more regular the swing, the better is the condition.

While Dr. Bernheim is not certain of the cause for this, he suspects that the calf muscles spread according to the amount of blood sent to them and then contract again in a rhythm. — *Science News Letter.*

Pituitary Gland Is Nature's Sculptor, Molding Human Face

The pituitary gland at the base of the brain, master of all endocrine glands of the body, has another role. It is Nature's sculptor which models the head, face and features of man. The mechanism by which the pituitary plays this newly-discovered "sculptor" role was disclosed by Dr.

Rector Mortimer, of McGill University, at the meeting of the American College of Physicians.

Finding how the gland acts to change facial features will aid the endeavors of physicians to diagnose and treat disorders of the gland. Dentists will also be aided in their own problems of facial and palatal growth.

Scientists have for years studied the question of the mode of growth in the human face in an endeavor to solve the question of those changes which make the Mongoloid features so different from either the Negroid or those of the white race, the Caucasoid.

Since the time of the great English anatomist, John Hunter, it has been known that facial bones —the foundation of the features—change through infancy to full adulthood by a process of modeling. It is as if a scluptor had, with his thumb, removed human clay from one part to smear it on another. Hunter showed that this occurred by the simultaneous processes of resorption in one area and deposit in another.

While Hunter's observation of this process of bone growth and development was true, it gave no indication of the mechanism by which it happened. Today confirmation has been given his observation and the mechanism explained in the light of modern knowledge of the pituitary gland.

It is the pituitary gland which, elaborating hormones that control growth in all its aspects, plays the dominant role in this mechanism. Removal of the pituitary in rats, Dr. Mortimer showed, stops entirely that differential part of growth which is called development — the process by which the small baby face of childhood becomes the large, well-grown, firm-jawed face of the adult man.

The essential process of resorption by which bone increases in size is made possible by the somatropic hormone from the pituitary, Dr. Mortimer said. This hormone lightly decalcifies the bony structure and expands its vascular bed. When the impulse to grow diminishes, consolidation takes place by a mechanism which is the reverse of that producing the expansion. In short, the flow of gain is followed by the ebb of consolidation.

Dr. Mortimer showed the process of expansion depends on the purified growth fraction of the anterior pituitary which today is labeled the somatropic hormone, and which is entirely free from any physiological effect on either thyroid, adrenal, or sex glands.

But the process of consolidation is less certain. It may occur, Dr. Mortimer indicated, through the intermediary action of the parathyroid glands in the neck, possibly as a result of stimulation of these glands by a parathyrotropic hormone also formed in the anterior pituitary. This latter hormone has not yet been identified but there is presumptive evidence for its existence which receives support from such scientists as Houssay of Buenos Aires and others, Dr. Mortimer said.

By the four types of characteristic cranial change which he demonstrated as occurring in over ninety per cent of the pituitary cases in the University Clinic of the Royal Victoria Hospital, Montreal, Dr. Mortimer offered a new datum for the use of physicians treating glandular disorders and those specializing in the treatment of children. — *Science News Letter.*

Cortin Promises to Conquer Wasting Disease of Children

Cortin, the hormone produced by part of the adrenal glands and recently hailed as a life-saving remedy for usually fatal Addison's disease, may prove to be very useful in ameliorating the unhappy effects of a baffling disease of children, muscular dystrophy.

Work done on several cases of progressive muscular dystrophy, hypertrophic muscular dystrophy, and myasthenia gravis, in comparison with other abnormal conditions and normals, was reported by Dr. M. X. Sullivan of Georgetown University to the American Society of Biological Chemists.

A chemist himself, Dr. Sullivan became interested in the muscle disease when he found it was accompanied by certain changes in the body chemistry. In this disease a substance called creatine, which is normally changed in the body to creatinine during muscle activity is excreted via the kidney as unchanged creatine, scientists found. Investigating further, Dr. Sullivan, aided by Dr. Walter C. Hess and P. Irreverre, found that relatively appreciable amounts of guanidine are excreted in this disease, generally in a combined form readily converted to free guanidine by oxidation with silver oxide or mercuric oxide.

Guanidine is a protoplasmic poison and prevents the passage of an impulse over nerves to muscles. The muscles remain inactive and gradually waste away. Glycine, long considered valuable in checking the progress of the dystrophies, did not eradicate the simple guanidine derivatives but did seem to check the progress of the disease more or less.

In one case of a seven year old boy, treatment for several months with cortical extracts taken in pill form brought about changes towards normality. The wasting of the muscle which characterizes this disease was checked, the appetite improved, weight increased, and the excretion of material yielding guanidine ceased.

Dr. Sullivan described a new colorimetric test which he had developed for free guanidine not given by combined guanidines. Material yielding free guanidine he finds is excreted in muscular dystrophies, especially pseudo-hypertrophic muscular dystrophy, but not in a similar disease of adults called myasthenia gravis. Some possibility exists that the cortin treatment taken early may actually have curative value. — *Science News Letter.*

Multiple Sclerosis Laid to Blood That Clots Too Easily

Blood that clots too easily, a condition quite the reverse of hemophilia, the bleeding condition made famous because it afflicts members of European

royalty, was put forward as the fundamental cause of the hopeless nerve disease, multiple sclerosis.

Experiments indicating this blood abnormality plus such outside influences as injury or infection cause the mysterious nerve disease were reported by Drs. Philip Solomon, Mary E. Dailey and Tracy J. Putnam of Harvard Medical School and Boston City Hospital at the meeting in Atlantic City, N. J., of the American Society for Clinical Investigation.

Pinning the disease onto a blood condition gives an entirely new and possibly more hopeful approach to the attack on the disease, since medical scientists have till now concentrated their efforts on finding an infection or poison which might be the cause of the malady.

Multiple sclerosis, once considered a rarity in America, is today becoming increasingly common, according to medical authorities. A patient rarely dies of the disease but he may be virtually helpless over a long period of years. Its most marked symptom is a progressive inability to walk. It is characterized by episodes of weakness from each of which a marked recovery is made, although the patient is left slightly weaker each time until paralyzed. Hardening of disk-like patches on the nerves gives the disease its name, multiple sclerosis, which translates into "many hardenings."

The discovery that a blood condition is at the base of this nerve disease rests on recent research of Dr. Putnam's. He found evidence that the disease is due to many blood clots forming in the small veins of the brain and spinal cord and obstructing these blood vessels.

Following this lead, Dr. Putnam's colleagues investigated the blood of multiple sclerosis patients to find whether it clotted more easily than blood of healthy persons.

A large proportion of the patients, they found, had more fibrin in their blood than normal persons. Fibrin is the essential portion of blood clots. The blood of multiple sclerosis patients does not ordinarily clot any more rapidly than that of normal persons. Its clotting, however, is greatly increased when the patients are given adrenalin or typhoid vaccine.

This explains for the first time, Dr. Solomon pointed out, the well-known fact that the onset or increases in severity of multiple sclerosis are often associated with injury, operation, exposure, infection, immersion, pregnancy or severe emotional excitement.

Any of these factors, but probably chiefly infections and injuries, occurring to persons whose blood clots more easily than normal, probably cause the numerous blood clots in veins of brain and spinal cord which, in turn, bring on the disease. — *Science News Letter.*

Convulsions in Childbirth Laid to Lack of Protein

Faulty diet was blamed for many of the cases of convulsions in mothers at childbirth in a report by Dr. Maurice B. Strauss of Thorndike Memorial Laboratory, Boston City Hospital, at the meeting of the American Society for Clinical Investigation.

These convulsions are characteristic of a group of diseases known as toxemias, which accounts for one-fourth of all maternal mortality, Dr. Strauss explained.

Feeding a diet containing a large proportion of protein foods in the early stages of this disorder, together with the injections of certain extracts, caused all symptoms to subside in the patients studied, Dr. Strauss reported.

"If the expectant mother does not eat enough protein food — meat, fish, eggs and milk — instead of losing weight she gains weight excessively, but this weight consists of water or 'occult dropsy'," Dr. Strauss said in reporting his latest studies on the condition.

In many cases this condition leads to what physicians term eclampsia, with convulsions and coma, or complete loss of consciousness, which frequently results in the death of both mother and child.

Studies which he began five years ago suggested that many of the toxemias which take such a toll of mothers and infants are the result of diets lacking proper nutritive qualities. For example, if the expectant mother does not receive enough iron in her diet, one type of anemia results. If she eats food low in the vitamin B complex, she may get a form of nerve paralysis or a primary type anemia. The importance of protein in the expectant mother's diet is the latest discovery Dr. Strauss has made in the course of these studies. — *Science News Letter.*

Correction

The readers attention is directed to an inadvertent error of spelling of the name Bauwens in the article of Turrell which we published in the December issue of the ARCHIVES.

Obituary

The Congress announces with deep regret the passing of our pioneer member, William Wallace McRae, of Corinth, Mississippi. Dr. McRae was a distinguished devotee of scientific physical therapy, and his fruitful labors will be sorely missed by his patients. We extend our deep-felt sympathy to Dr. McRae's family.

Pacific Physical Therapy Association Meeting

The regular January meeting of the Pacific Physical Therapy will be held January 22, 1936, Hollywood Hospital, Hollywood, California. A symposium on Low Back Pain will be presented as follows:

1. "Demonstration of Physical Therapy Applied to the Lower Back" by *Cora Smith King*, M.D., Hollywood. Discussion: Wm. W. Worster, M.D., San Gabriel, California. 2. "Anatomy of the Lower Back" by *Samuel Crooks*, M.D., Loma Linda, California. 3. "Diagnosis and Treatment of Low Back Pain" by *Alfred E. Gallant*, M.D. and *H. Waldo Spiers*, M.D., Los Angeles, California.

Note: A new feature of their program will be a technical demonstration for which a demand has arisen.

THE STUDENT'S LIBRARY

MECHANICS OF NORMAL AND PATHOLOGIC LOCOMOTION IN MAN. By *Arthur Steindler,* M.D., F.A.C.S., Professor of Orthopedic Surgery, The State University of Iowa, Iowa City, Iowa. Cloth. Pp. 424, with 453 illustrations. Price $8.00. Springfield, Illinois: Charles C. Thomas, 1935.

The mechanics of human locomotion has been a problem that has engaged the attention of man since time immemorial. Traceable evidence of its empirical value is found in the writings of ancient Egypt, Assyria; on the basis of pure physics it was the special contribution of Italian science during the sixteenth and seventeenth centuries; its conception as a physiologic entity and its mathematical interpretation came with the development of English and German science; and its present advancement along the ancillary sciences of biochemistry and biophysics has been shared by America and other countries during the last and present centuries. Steindler has rendered modern medicine an outstanding service by correlating and interpreting a tremendous and disorganized amount of valuable information within the confines of the present work, a work outstanding both for theoretical detail and practical interpretation of this important problem in the economy of human health and comfort. He has no illusions that the reader "expects in return for patiently accepting a lengthy theoretical preamble" a practical interpretation of the problem. This has been the major objective of the author, and the contents are proof by its scope and the wealth of information related to orthopedic and physical education. The volume is divided into two sections and thirty chapters, presenting the history, scope, mechanics, dynamics, electrophysical and physiologic action of the various parts related to the normal and pathologic mechanics of locomotion in man. Here is a contribution of outstanding scholarship, written by one of the foremost orthopedic surgeons who has attempted to present the physical theories of locomotion in order to better to appreciate the physiologic and pathologic events that must follow. Steindler has harnessed theory and practice under a single yoke for the benefit of medical practice.

RÖNTGENOLOGY. THE BORDERLANDS OF THE NORMAL AND EARLY PATHOLOGICAL IN THE SKIAGRAM. By Prof. Dr. med., *Alban Köhler,* Wiesbaden. Ex-President and Honorary Member of the German Röntgen Society; Life Member of the Swedish Medical Society; American Röntgen-Ray Society; Belgian, Spanish and Mexican Radiological Society; Society of Physicians of Vienna; Röntgen Society of Vienna and Dermatological Society of Vienna. Second Edition. Translated and Edited by *Arthur Turnbull,* M.A., B.Sc., M.B., Ch.B. (Glasg.). Ex-Demonstrator of Anatomy, University of Glasgow. Cloth. Over 400 illustrations. Pp. 682. Price $14.00. Baltimore: William Wood and Company, 1935.

For physicians, who are beginners or have not yet had sufficient experience in roentgenology, the work is a guide to a diagnosis of tissues which exhibit, or appear to exhibit slight and not particularly noticeable divergencies from the normal anatomical picture. For such cases there was no complete work in the Roentgen literature as the atlases of normal anatomy give only roentgenograms of every day typical conditions, while the atlases of pathological anatomy contain only pictures of very pronounced diseases, recognizable as such without great difficulty. Owing to the tremendous extent of modern technique of Roentgen diagnosis, which no single roentgenologist can possibly master, the author has limited himself to the *direct presentation* of the organs and systems of the human body and to contrast methods of examination used daily by roentgenologists. This edition includes not only the contents of the sixth German edition, which has been carefully revised, but also the latter advances in medical roentgenology of the normal and the beginnings of the pathological. The English version includes in addition to the German all related British and American works. The index has been greatly enlarged and provided with cross-references. This work will be welcomed as a most useful aid to the study and solution of roentgenologic problems. The illustrations are in many instances most striking and instructive and add materially to the information imparted. As a work of reference this volume is a veritable mine of information for students, practitioners and specialists.

SHORT WAVE THERAPY AND GENERAL ELECTRO-THERAPY. By *Heinrich F. Wolf,* M.D., Consultant, Department of Physical Therapy. Mount Sinai Hospital; Director of the Department of Physical Therapy, Neurological Hospital, Welfare Hospital, Welfare Island; Chief, Arthritis Clinic, Union Health Center Boards. Pp. 96, with 80 illustrations. Price $2.50. New York: Modern Medical Press, 1935.

This book from the pen of an eminent and critical author in the domain of physical therapy in America is the most astonishing effort under his signature. It is a work purporting to present the elementals of short wave therapy and general electrotherapy (illustrated) to busy practitioners, "who want what they want when they want it and want it handy." The author therefore cannily met the demand by a supply of what he terms as "a concise book on technic to reduce the dangers which

lie in the incorrect use of methods of physical therapy by physicians who want to employ them but who feel that they cannot devote much time to their study." It is unfortunate that sentimentalists will lose themselves in sophistries in order to hide their limitations. What the author calls concise is an attempt to abbreviate the technic of the entire realm of electrotherapy in a scattered and widely spaced exposition with schematic drawings, the former being as unauthoritative as the latter are highly imaginative. It is deeply to be regretted that the author's sympathies lean toward that group of obstructionists to medical progress who impatiently want that which is at their very elbow, but who are too indolent to exercise their intellectual prerogatives to acquire it. After ten years of valiant effort by the Council on Physical Therapy of the American Medical Association to correlate, organize and publicize scientific methods in physical therapeutics it is high time that organized medicine voice objection to a work as deficient in scholarship as it is erroneous in purpose. This book will teach few and misguide most because it contains little from which to draw. It is certain that anyone attempting to follow the directions in it will be sorely confused or amused (see pages 24 and 43).

HOSPITAL ORGANIZATION AND MANAGEMENT. By *Malcolm T. MacEachern*, M.D., C.M., D.Sc., F.A.C.P., F.A.C.H.A., Associate Director American College of Surgeons, and Director of Hospital Activities. Cloth. Price, $7.50. Pp. 944 with 22 illustrations. Chicago: Physicians Record Co., 1935.

The author of this volume occupies a most enviable position in the hospital world and no one is better qualified to write upon the subject of hospital administration. Today hospitals must be organized and administered scientifically. This requires that every department executive should be familiar with the hospital management as a whole. The chapters show breadth of the hospital problems of interest to executives and to medical staffs. An entire chapter ably outlines methods for the promotion of a new hospital. Another chapter discusses fully the building of a new hospital, while one deals with the entire problem of its organization. The admitting, clinical, nursing, dietary, outpatient, social service, medical records, business and service departments are discussed in detail. The functions, qualifications, appointment and organization of the medical staff are clearly defined. The organization and administration of the physical therapy department is considered in a special chapter on adjunct diagnostic and therapeutic facilities. Discussions of the ethics of the hospital and of public education are admirable and opportune. Legitimate means are pointed out to inform the medical profession and the public of the benefits to be derived from the physical therapy department. This book should be in the library of every physician directing a hospital, a department of physical therapy, or who is otherwise interested in the success of hospitalization of patients.

THE DOCTOR AND THE PUBLIC: A STUDY OF THE SOCIOLOGY, ECONOMICS, ETHICS AND PHILOSOPHY OF MEDICINE, BASED ON MEDICAL HISTORY. By *James Peter Warbasse*, M.D. Cloth. Price, $5.00. Pp. 572 with 19 illustrations. New York: Paul B. Hoeber, Inc., 1935.

This volume is an inquiry into the physician's place in society. The author believes that the physician utilizes his training for the prevention, diagnosis and treatment of disease. These methods which the physician so successfully applies to his problems are not employed by him as regards his own relation to the socio-economic environment in which he lives. Warbasse is especially qualified to discuss this subject. An active surgeon in New York until 1919 and the author of numerous surgical works, he retired from active practice to devote himself to the economic aspects of medicine. The first seven chapters are devoted to an interesting historical review of the art of protecting health. There are many interesting facts in this section about the development of physical therapy with mineral springs, massage and exercise. This part of the book runs the gamut from Epidaurus to the custom of treating rickets by passing the affected child across the split crotch of an ash tree in the presence of the rising sun. The final chapter discusses the public demands on the benefits of the medical art. The author believes that there is need for more physicians in the United States, and that the medical profession must show society how to make a larger use of its medical talent and to distribute physicians where most needed. He believes that prevention of disease is essential and that the treatment of disease is too often a confession of defeat. In this final chapter Warbasse sociologically takes up business competition in medicine, state medicine, guild socialism, group practice and health insurance. In these days of the breaking down of the existing competitive business system and the socialization of the forces for the protection of health, this book should be of interest to every physician.

WHEAT GERM OIL — VITAMIN E. By *August J. Pacini*. With an introduction by *Harry E. Dubin*. Board. Pp. 96. Price, $1.25. New York: American Physician, Inc., 1935.

Three names are associated with the development in America of the vitamin industry — Funk, Dubin and Pacini. Of these, the latter is perhaps best known for his contributions on ultraviolet light. The present volume represents an original and stimulating research concerning vitamin E, carried out by the author in his well-equipped biochemical laboratory. He has for seven years past. devoted much attention to vitamins D and E. His vitamin D studies have been productive of an interesting method for the synthetic preparation of this material from ergosterol, a method which is now available in medical and food fields. His present studies on vitamin

E have for the first time made available to the medical profession a trustworthy source of information on wheat germ oil. The extent and character of the present contribution is couched in a style as lucid and terse as it is informative. It reveals the composite nature of wheat germ oil, identifies at least five probable fractions, and treats its relation to vigor. The author's special training has enabled him to detect the biochemistry of vitamin E deficiency by the galvanic current. The relation of vitamin E to mentality and to the endocrines is quite thoroughly discussed, as is the relation of wheat germ oil to the development of aberrant tissue proliferation expressed as deciduomata of the uterus and carcinoma in experimental animals. The author establishes the relation of vitamin E to testicular degeneration and sex function. His studies on the distribution of vitamin E challenge many statements alleging its widespreadness. Of especial interest is the information that sterility, whether brought on by diathermy in the treatment of spididymitis, x-ray and radium treatment for whatever cause, or other forms of physical trauma, is favorably influenced by vitamin E therapy. To this is added that individuals continuously exposed to dangerous radiations will derive benefit from daily ingestion of vitamin E. Not the least important part of the book is an abstract of over 150 articles alphabetically arranged and the supporting bibliography of more than 200 references to vitamin E. An introduction by Dubin lends added prestige to this small volume, from which we quote a passage that tersely characterizes its contents. "If wheat is the staff of life, then the oil from its germ must be the elixir of life."

INTERNATIONAL ABSTRACTS

Late Changes in the Mucosa of the Frontal Sinuses and Nose of Dogs Following Ionization. Bernard J. McMahon.

Arch. Otolaryng. **22**:454 (Oct.) 1935.

From experiments made last year by the author he concluded that definite destructive changes were brought about in the mucosa of the frontal sinuses of dogs by the ionization of a solution of zinc sulphate in the sinuses. These changes consisted of ballooning, fragmentation and complete destruction of the surface epithelium in most places, marked edema and partial disintegration of the subepithelial tissues and extravasation of free red blood cells into these tissues from greatly dilated and ruptured capillaries. As a result of these immediate extensive changes it was felt that in the process of regeneration of the mucosa more extensive permanent changes might be brought about, and it was with the idea in mind of studying the possible progressive changes that animal experiments were conducted.

Summarizing his results, the author states: "A study was made of the effects on the mucosa of the nose and frontal sinuses of dogs following ionization, the immediate widespread destructive changes and the readjustment of these delicate tissues characterized by a progressive accumulation of connective tissue in the tunica propria, as evidenced in dogs killed eighteen hours, two weeks, four weeks, seven weeks, and twelve weeks, respectively, after ionization. The changes observed in the mucosa and bone of the frontal sinus are further corroboration of the reaction of such tissues to extreme irritation.

From a clinical standpoint, however, interest is centered on the changes in the mucosa of the nose. Should generalized fibrosis of the nasal mucosa be considered as an optimum state for the proper functioning of that mucosa? Increased and excessive fibrosis means depletion of the blood supply to these structures and further fibrosis; it means atrophy of the glands due to compression as well as depression of secretions, and compression of nerves with the imminent probability of giving rise to nasal pains, hyperesthesia, neuritis and headache of a more or less intractable nature, even though there is apparently no damage to the nerve structures themselves.

All of these changes would not be expected to take place within a few months in the nose of a human being which has been ionized, as the individual reaction is too variable as to time, but there is ample reason to fear that within a comparatively short time a condition would be brought about which might be aptly termed a premature nasopause."

Action of High Tension Electric Current. E. O. Manoiloff.

Wien. klin. Wchnschr. **48**:495 (Apr. 19) 1935.

Manoiloff describes studies on rabbits, which demonstrated pathologic changes in the nerve cells of rabbits that had been influenced by alcohol. He found that the action of the high tension electric current results in fatality much oftener in alcoholized rabbits than in those that have not been treated with alcohol. He concludes that persons who work with the high tension electric current are always exposed to danger and should avoid the abuse of alcohol. — [J. A. M. A., **104**:2221 (June 15) 1935.]

Studies on Blood With Infrared Photography. A. Fröhlich, and G. Rodenacker.

Mün. med. Wchnschr. **82**:146 (Jan. 24) 1935.

Fröhlich and Rodenacker show that by means of infrared photography it is possible to recognize carbon monoxide blood. With suitable wavelengths they were able to differentiate oxyhemoglobin from reduced hemoglobin. Moreover, they proved with infrared photography the impairment of hemoglobin following complete dissociation of carbon monoxide poisoning, and they were able to give photographic proof of the favorable action of methylene blue in the clinical treatment of carbon monoxide poisoning. The authors are now conducting experiments to improve the method further and extend it to isolated hemoglobin. — [J. A. M. A., **104**:1048 (Mar. 23) 1935.]

A New Therapeutic Diathermy Electrode. Frank W. Law.

Brit. J. Ophthal. **29**:96 (Feb.) 1935.

The electrode was designed for use in certain diseases of the eye by the diathermy current. Hitherto the current has been applied to the eye by means of a simple circular zinc or lead electrode fixed in a rubber band which encircles the head; the advantages over this form which are claimed for the new electrode are:

The head band can be applied firmly and securely independently of the electrode, the pressure of which upon the eye is capable of separate adjustment. With the former instrument the pressure of the head band was transmitted directly to the eye. The construction of the electrode allows of close and accurate apposition to the eye whatever the facial conformation. The efficiency of the application is increased, as witnessed by the fact that the milliampere meter readings with the new electrode are constantly lower than with the old type. The comfort of the patient is greatly increased.

The electrode consists of base plate which is introduced beneath two rubber flaps on the reinforced headband; the ends of the band are pierced by holes, and the band is secured at the proper tension around the head by fastening over a button at the appropriate holes. Into the base plate is fitted, by means of a rotatory joint, a stem which is broken by a flat joint with a milled hand screw clamp to allow of vertical adjustment of the actual contact piece. The upper end of this stem is pierced by a circular hole through which slides a rod, suitably curved at the contact end; this rod is again secured by a thumb screw. Provision is made in the stem for the reception and fixation of the insulated lead from the apparatus.

The cases in which the diathermy current finds its most valuable application are those of subacute glaucoma. On only the rarest occasions does it fail to relieve the tension, and it appears to be a definite adjuvant in the action of drugs such as eserine; even more important than the immediate effect is the fact that a daily application for a few days will usually produce a quiet eye, with tension normal or only full, upon which a trephine or sclerotomy operation may be safely performed instead of an emergency iridectomy.

An eye acutely inflamed from any cause is benefited by diathermy. Good results have been achieved in cases of hypopyon ulcer, episcleritis and interstitial keratitis; threatened or early intraocular infection, especially after operation or the reception of an intraocular foreign body, is well combated by this means. Acute and subacute iridocyclitis appears to be considerably helped, and acute choroiditis has been treated with apparent benefit.

Do Narcotics Influence Action of Therapeutic Fever? I. Wehner.

Med. Klin. **31**:482 (April 12) 1935.

Wehner points out that the extremly high temperatures in fever therapy are frequently accompanied by severe headaches, nausea, vomiting, pains in the muscles and joints, palpitation of the heart, dyspnea, insomnia and other symptoms, so that the patient demands the premature interruption of the treatment. For this reason it would be desirable to give the patients remedies that would reduce these symptoms. Antipyretics are inadvisable because by reducing the fever, they would defeat the object of the fever therapy. The author decided to try different narcotics and found that opiates and certain barbituric acid derivatives reduce some of the undesirable symptoms without interfering with the biologic action of the fever therapy. — [J. A. M. A. **104**:2138 (June 8) 1935.]

Therapy With the Cold Quartz Lamp in Dermatology. A Preliminary Study of Therapeutic Effect and Dosage. Carroll S. Wright.

Arch. Derm. & Syph. **31**:374 (March) 1935.

There is scarcely any physical agent used by dermatologists that has suffered more vicissitudes than the ultraviolet ray lamp, since Finsen more than thirty years ago successfully cured a patient with tuberculosis of the skin.

Within recent years a new source of ultraviolet rays has been introduced in the form of the "cold quartz" ultraviolet radiation generator or lamp. The introduction of this lamp has increased the facilities for more accurate therapeutic use as regards dosage and effectiveness and offers new fields for research. The author observed no serious untoward effects following the use of the cold quartz lamp in local therapy of diseases of the skin. Herpes labialis developed in three patients whose lips were insufficiently protected. Many patients objected to the burning sensation that they experienced several hours after exposure to the lamp and also to the desquamative process which persisted for about three days. The burning sensation can be greatly relieved by the application of cold cream to the treated area for a few hours after exposure. I have noted virtually no pigmentation of the skin.

Wright points out that with the cold quartz lamp 95 per cent of the total radiation of wavelengths less than and including 313 millimicrons is emitted in the resonance line of mercury at 2,537 angstroms. The short wave rays produce erythema and resulting desquamation but do not appreciably pigment the skin. The cold quartz generator has a short building-up time and an almost constant output, not varying with different generators of the same type or with the age of the generator. The constancy of output makes possible an accurate estimation of dosage and brings the medical profession closer to securing a standard unit of dosage of ultraviolet radiation. A number of diseases of the skin respond favorably to radiation from the cold quartz lamp, although it should not be used in those diseases which are unfavorably affected by sunlight. In persistent cases of acne vulgaris irradiation with the cold quartz lamp often frees the patient from lesions and lessens the degree of scarring. No more undesirable effects have been noted than erythema, desquamation and the occasional development of herpes labialis.

Fluorescence of Fungus Colonies With Filtered Ultraviolet Radiation (Wood's Filter). George M. Lewis.

Arch. Derm. **31**:329 (March) 1935.

While the investigation has not reached completion, certain tentative conclusions may be recorded. Many different species of fungi fluoresced in filtered ultraviolet radiation in characteristic and individualistic colorations. With some species the colors were distinctive as early as three or four days following implantation of the inoculum. With other species the fluorescence was vague, and the colors were not distinctive at any stage of the growth. The method was of certain value only in the first three weeks of the growth of the colony. The study of fresh transplants from old cultures was not satisfactory if the original colonies had undergone pleomorphism. The fluorescent characteristics of microsporon lanosum and M. Audouini were dissimilar. The practical importance of distinguishing between these two organisms was pointed out in another communication. Other fungi in culture showed fairly characteristic colors:

(a) E. inguinale: The fluorescence of the growth for the most part was olive green, the border being a lighter green. The pleomorphic duvet was bluish white. The medium became canary yellow.

(b) Trichophyton interdigitale: At seven days the entire colony was fairly bright, deep lavender.

(c) Trichophyton cerebriforme: At seven days the center showed a brilliant, greenish-yellow hue; around this was a band of dull lavender; the outer edge was bright light blue. At twelve days the convolutions were predominantly bright sulphur yellow with some purplish areas; the border was a dull light blue.

Contrary to the experience of Bommer, it was found that some fungi when growing on Sabouraud's dextrose medium exhibited characteristic and individualistic fluorescent colorations when viewed in filtered ultraviolet radiation (Wood's filter). These colors were best observed in ordinary cultures during the first three weeks of the growth. Pleomorphic growths lost the typical colors seen earlier. The method appears to be particularly applicable to a rapid differentiation of M. lanosum and M. Audouini, but it was also of use as an aid in the recognition of other fungi.

Balneotherapy. E. Pulay.

Balneologe, **2**, 1935.

A hot compress warms and hyperaemises not only the skin, but also the internal organs belonging to this segment, in consequence of the vegetative correlation, so that, for instance, the liver produces more bile. In contrast to this, blood is drawn away from the other internal organs, with the exception of the lungs and kidneys, if the entire skin of the body is hyperaemised, for example, in a warm bath. On the contrary, in a cold bath, blood is brought to the internal organs. Cold causes acidosis and sympathicotony (analogous to the effect of adrenalin: Increase of the blood calcium and along with this, reduction of the alkali reserve). Warmth causes alkalosis and vagotonia (just as pilocarpine and magnesium). Every change in the mineral metabolism (electrolyte system) influences predominantly the hormonal system, as the glands of internal secretion are vegetatively stigmatised. Especially with mud procedures, Russian authors were able to determine a rise of the potassium and a decrease of the calcium and NaCl content of the blood. The specific effect of baths is due to the ionic permeability of the hyperaemised skin. An exchange of ions between the skin and the bath fluid takes place.

With drinking courses of treatment as well, the electrolytes play a large part, along with the movement of water. The requirements for a drinking cure are not only sufficient kidney elimination, but also normal function of the thyroid gland, the hypophysis, and the liver, which have control over the extrarenal water metabolism. Under-fuction of these organs lead to water retention. If the Volhard test (elimination of a large amount of water within 6 hours at the most) shows retention, then, if the kidneys are normal, the energy metabolism (thyroidea, hypophysis) and the liver function should be tested. A disturbance in the electrolyte balance can be determined by the chemical testing of the blood, and can be regulated by the administration of the reduced electrolytes (calcium, magnesium, etc.) Thus, with chlorine acidosis, which is by no means rare (NaCl retention, reduction of the alkali reserve), drinking cures with magnesium are indicated, whereas sodium is contraindicated. Sodium chloride poisoning causes over-acidizing of the tissue, and thus an increased tendency to inflammation. The symptoms are headache, migraine, dizziness, sleeplessness, sweating, tendency to rheumatism, to ulcus ven-

triculi and duodeni, to eczema and urticaria, to asthma and hay fever. Here, saltless, antiphlogistic diet plays a great rôle.

With pruritus, itching eczema, neuritis, sciatica, etc., the examination of the blood not infrequently discloses a latent diabetes. Here, above all, the hyperglycaemia and any chlorine acidosis must be eliminated, by alkaline drinking cures and diet. With increased blood urea, radium baths or drinking cures are the best. With chlorine acidosis, mud packs and other heat procedures also have a favorable effect. Incretoric disturbances of the water household may also cause neuralgia and rheumatism. With urticaria, the patient should also be examined for water retention or insufficient water intake or increase of the blood urea or chlorides. — [Ars Medici **13**:456 (Oct.) 1935.]

Artificial Climate — A New Service to Hospital Patients. C. A. Mills.

Modern Hospital, **43**:57 (Oct.) 1934.

One of the newest calls for added hospital expense relates to more complete control of indoor atmosphere. Mere winter heating of the air is no longer considered sufficient. We must have humidity control, washing and proper air circulation. Cooling during summer heat waves completes the scheme for year around control of the indoor environment.

As a result of six years' work, we are now fairly certain that man derives his energy and vitality from the climate under which he lives. In cool, stormy regions bodily vigor is greatest, with a high level of heat and energy production, while in the stagnant moist heat of the tropics man is most sluggish and least able to meet physical emergencies. Where the environment is for long periods characterized by unchanging warmth, man loses his capacity for quick response to chilling, his adrenal activity sinks to low levels, and a relaxed body state prevails. If such an individual migrates into northern storminess he finds himself extremely susceptible to the cold spells and readily afflicted with respiratory affections. For comfort he needs an indoor temperature several degrees above that of the more active northerners.

Hand in hand with the changes in energy level go differences in resistance to infection. Moist heat that depresses body metabolism makes for an increased susceptibility to infection and lessened ability to fight bacterial invasions once they have gained a foothold. Definite differences exist in this respect between active northerners and southerners of more sluggish metabolism. Of each one hundred cases of acute appendicitis handled in hospitals, the fatality rate is almost three times as high in the south as in the north, with a steady lowering of the fatality rate as one goes northward from the gulf region. Close study of the facts indicates that this difference is not due to better hospital or medical handling in the north but that it depends on a basic difference in the human resistance to infection. Acute nephritis shows a similar high death rate in the south and a low rate in the more stormy north.

Sudden lowering of man's resistance comes with such summer heat waves as those afflicting a large portion of the United States during the past summer. Soon after the onset of such heat, man's blood pressure falls, his energy lessens and his ability to fight infection shows a sudden decline. Acute appendicitis at such times often assumes an almost epidemic character, going rapidly into perforation and spreading peritonitis, so that early operation is imperative. Cases of tuberculosis that begin to show symptoms first in the July and August heat run a course the most rapid of the whole year with the exception of the month of April. In the southwest, the favorite region for treating tuberculosis, the high daytime temperatures of summer exert a deleterious effect on patients.

Properly constructed hospitals would find little difficulty in providing any type of artificial climate a physician might desire for particular purposes. Portable equipment for heating or cooling, for added moisture or drying the air, could be moved from room to room as needed. One room could easily be arranged for tropical moist heat for use in securing a fall in blood pressure and body relaxation while the adjacent room could be kept at a low or variable temperature as needed for its occupant. Some patients need a stability and evenness of temperature while others do better with fairly wide day to night fluctuations. With due foresight hospitals can meet these needs with little expense.

Knowledge of climatic and weather effects is still of recent origin and far from complete. Time is required to put new findings into therapeutic use with safety to the patient. What I am urging upon hospitals is preparedness for future demands. Such preparation in new structures will cost little and may greatly enhance future usefulness.

Tubus for Marginal Ray Treatment of the Mucous Membranes. Gustav Bucky.

Derm. Wchnschr. **18**, 1935.

Bucky's marginal rays have proved to be especially suitable for the treatment of skin diseases, as they are completely absorbed in the first few millimeters of the skin, and are relatively harmless (see »Ars Medici«, 1935, p. 279). It is a short step to the use of these rays for diseases of the mucous membranes as well. For the treatment of such affections, up to the present time, we had only the Kromayer lamp with the quartz attachment at our disposal, and this is often insufficient on account of the slight, deep effect of the ultraviolet light. For this reason, H. Berger (University Skin Clinic, Leipzig) constructed a tubus which can easily be attached to the marginal ray apparatus, and thus makes the irradiation of mucous membranes possible. Especially with lupus of the oral mucous membrane, the instrument has proved very convenient. In accordance with the usual window-skin distance used with marginal rays, the tubus is put out in two forms, with 5 or 10 cm. window-skin distance, so that one only needs to put the instrument onto the mucous membranes. A filter holder comes with the apparatus. This may be set onto the small end of the conical upper portion in a ring provided. — [Ars Medici **13**:484 (Oct.) 1935.]

PREVENTION OF DEFORMITY AND DISABILITY *

Its Underlying Mechanical and Physiological Principles

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In 1863, John Hilton wrote in his treatise "Lectures on Rest and Pain," the following statements:

> By therapeutics I do not mean to imply the action of drugs, which more especially belongs to the department of the physician; but rather the influence of what I may venture to call "Natural Therapeutics" in the cure of surgical diseases. The chief of these is one so apparently simple as to make me almost apologize to you for selecting it. It is Rest — Physiological as well as Mechanical Rest — which I hope to prove in the course of these lectures to be so important as to demand the very serious attention of every practical surgeon.

A more general and intelligent understanding and application of the fundamental mechanical and physiological principles underlying the prevention of deformity and disability should be encouraged by members of the medical profession. Every effort should be made to reduce the degree of deformity and the percentage of disability in patients who suffer injury or disease affecting the apparatus of locomotion and prehension. The number of preventable conditions of the human motor apparatus can be diminished appreciably if the profession foster the teaching of the mechanistic conception of disease and the basic principles of mechanical and physiological rest.

The pioneers in this country who taught and emphasized the meaning of the mechanistic concept of disease were or are active members of the various American orthopedic societies. Mechanical and physiological principles, as applied to the prevention and cure of disease, have been introduced during recent years in the curricula of our medical schools. The medical student who does not acquire a knowledge of these principles cannot develop a complete conception of the cause, prevention, and treatment of disease. The physician whose armamentarium is void of sound mechanical and physiological principles is not prepared to assume the complete responsibility of the management of the many diseases and injuries which affect the motor system of the human body.

A clinical examination of a joint includes not only a study of the bones, cartilage, and capsule which enter into its formation, but also an analysis of the neuromuscular and vascular systems which control the functions of the articulation. Tendons and their gliding mechanisms, the sheaths and bursae, ligaments, fascial planes, surface temperatures, movements, stability, gaits, weight bearing lines and measurements are other factors which should be seriously considered in a detailed examination of a joint. Radiographic, chemical, pathological, bacteriological and other laboratory tests provide additional information and opportunities for positive diagnoses. It is a fundamental teaching that before instituting treatment a positive diagnosis should be established whenever possible by a complete examination exhausting all necessary clinical and laboratory facilities.

Principles of Therapy

A great variety of diseases affect the spine and extremities, or the bones, joints and soft tissues which control locomotion and prehension. The functions of the bone and joint system are primarily mechanical, therefore the basis of treatment of the many diseases which threaten to destroy or thwart

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 10, 1935.

this system must include principles which are mechanical in nature. The mechanical functions of the motor system depend upon the physiologic state of its various tissues; therefore, the second basis of treatment involves principles which are physiologic in nature. The principles of treatment are mechanical and physiological; the therapy is based on applied anatomy and physiology.

The field for the practical application of these principles is large and they may be effectively applied as a part of the therapy for any disease or injury which may possibly terminate with partial or complete loss of functions of the extremities and spine. Fractures, dislocations, paralyses, burns, bone and joint infections, the arthritides, obstetrical injuries, nutritional, endocrine, and other less common problems may often require the intelligent use of the principles considered in this paper.

The soundness of these principles has been evident to many surgeons of the past and present. The exact and scientific understanding of many of them provides a most fascinating and unexplored territory for present and future research. Not a few of the specific remedies which today have a scientific basis were employed empirically for many generations. Subsequent investigations will ultimately give scientific approval to many of these principles which at present are emphasized only because of the favorable results which practical physicians have observed during and after their proper application.

The orthopedic specialist is primarily concerned in his practice with the correction of deformities and the restoration of the functions of the various parts of the apparatus of locomotion. As a teacher he instructs in the underlying mechanical and physiological principles which will prevent deformity and preserve the functions of locomotion. He has less opportunity to apply these principles as compared with other members of the medical profession; however, he is more cognizant of their meaning and importance since too frequently he sees the crippling and disabling conditions which result from a lack of their understanding and improper application. Collectively these principles have been termed "mechanical and physiological rest." They were investigated and applied in the past by such men as John Hunter, John Hilton, Hugh Owen Thomas, Just Lucas Championiére, and Sir Robert Jones. Sir Arthur Keith stated in "Menders of the Maimed" that, "it was the custom of John Hunter to prescribe 'rest' as a routine measure in the treatment of disablements of the motor system of the human body. John Hilton regarded rest as the most powerful aid of disordered tissues, and Hugh Owen Thomas made rest his creed and ritual."

Practically all physicians who treat the various diseases of the human motor mechanism daily apply many of the principles of "physiological and mechanical rest." In general, however, the conception of the term "Rest" is incomplete and confused. A program will vary according to the particular disorder and to the same derangements in different individuals; the underlying and basic principles, however, remain constant.

Program of Therapy

The multiplicity of principles which may be involved in a program of treatment should be orderly arranged and grouped into a system as expressed (table 1).

The principles which are applied in the program of treatment aim for the preservation of functions and the prevention of deformities. The selection of principles in an individual case depends upon the course of reasoning which the physician follows. The physician who repeatedly asks himself, "What conditions must I prevent during the course of treatment?" will

TABLE 1. — *Mechanical and Physiological Rest*

Phase 1.	Surgery when indicated.
	(a) Open surgery.
	(b) Manipulative surgery.
Phase 2.	Fixation in the optimum positions.
	(a) Optimum positions when restoration of function is anticipated.
	(b) Optimum positions for ankylosis.
Phase 3.	Maintenance of the integrity of the neuromuscular, vascular, skeletal, and articular systems by physical therapeutic measures.

utilize a larger number of available principles and will experience fewer complications than one whose thoughts and interests are confined to a single problem, such as the union of a fracture, the healing of a burned area, or the serum therapy for atrophic arthritis and infantile paralysis. Pressure neuritis, pressure necrosis, intra- and extra-articular adhesions, contractures, muscle atrophy, ankylosis of joints in bad functional positions, stretching and relaxation of ligaments, gravity edema, impairment of the circulation, shortening, lengthening and angulation deformities, and many other complications, are not infrequently preventable. Students and physicians should consider these problems as serious from the very beginning of the therapeutic program and utilize the simple and readily available mechanical and physiological principles which prevent them. It should not be necessary for the student to wait for a period of practical observation and experience before the importance of this teaching is recognized.

Deformity and disability can be appreciably reduced if physicians approach the many diseases and injuries of the extremities and spine with the above therapeutic program in mind. The three phases of treatment are of equal importance and neglect of one may vitiate the ultimate and final functional result. Many of the principles to be applied in an individual case are frequently confused or not even considered. If the physician adopts the program of "physiological and mechanical rest" with its three separate phases of treatment, it is certain that more of the principles will be evaluated and utilized. Throughout the course of treatment the physician should check his omissions and commissions and ask himself, "Have I neglected any one of the principles included in phase 1, 2, or in phase 3 of the therapeutic program of 'physiological and mechanical rest?'"

Limitation of space prevents a detailed consideration of the numerous principles included in each one of the three phases of "physiological and mechanical rest." The principles are generally known by all well informed and competent physicians. Unfortunately many of them are abused and commercialized. Others have been condemned and discarded by men who fail to recognize that the principles are sound and scientific but that their application was faulty. Instructions to the patient regarding the correct application of a principle are too often brief and inadequate. The physician must give much of his own personal time and patience explaining to the patient in a very simple, direct and insistent manner, the various measures and methods which require his active and complete cooperation. The patient must recognize that he plays an important rôle in the therapeutic program, and that his active assistance is as essential as any piece of mechanical apparatus, drug or operation. Not infrequently the patient is the only source for the supply of certain prescriptions. It is not difficult during these days of economic stress to persuade the patient to lean on the arms of his own physiological and mechanical mechanisms instead of relying on many of the expensive and mysterious types of apparatus which have been disseminated throughout the private and institutional walls of our profession. Excellent and perfect functional results are to be observed following therapeutic

programs which include principles whose application require simple and inexpensive equipment.

A long list of examples could be presented to substantiate the fact that the reason for numerous surgical tragedies with loss of function of one or more parts of the locomotor apparatus has been negligent application of one or more of the three phases of "physiological and mechanical rest." Contraindications to the use of the principles of each phase demand as much emphasis as do the indications. Proper execution of the principles of each one of the three phases requires judgment, skill and an adequate armamentarium.

Surgery When Indicated (Phase 1)

The principles relative to the first phase receive so much emphasis in our system of teaching that the student considers the principles of the second and third phases to be of minor importance. In fact, phase 1 is first only in the outline of the program of treatment and in many instances proper therapy excludes all of the principles included in it. Every effort should be made to impress upon the student that the principles of phase 2 and of 3 are equally as important and practical as those of 1.

Fixation in Optimum Position (Phase 2)

The principles of fixation vary according to whether restoration of function is or is not anticipated. Accordingly there are optimum positions for fixation when return of function is expected and optimum positions for ankylosis. The positions for fixation of fractures depend upon the type of fracture and the anatomic region fractured. It is not the purpose of this paper to review the numerous positions of fixation for all fractures, but to emphasize the need of a clearer conception of the general treatment of fractures by means of "mechanical and physiological rest."

The optimum positions for fixation of the extremities and spine during the acute paralytic stage of infantile paralysis are shown (table 2 and fig. 1). These positions are optimum because the lower extremities

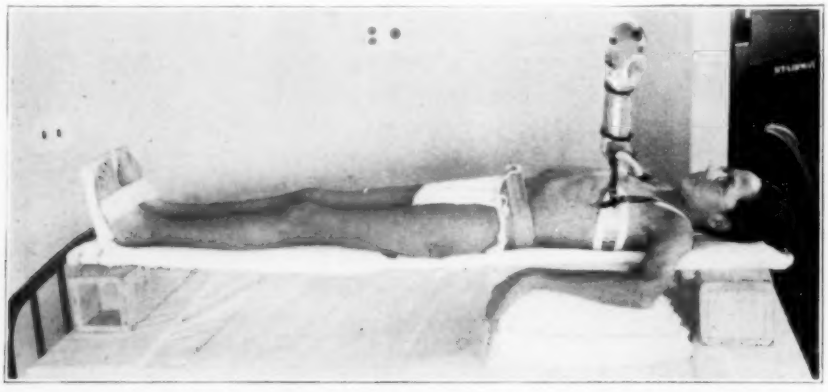


Fig. 1. — Patient with extensive paralysis of both lower and right upper extremity during the acute tender paralytic phase of anterior poliomyelitis. The affected extremities are immobilized in the optimum positions for restoration of functions. Proper fixation and physical therapy will prevent contracture deformities. (See fig. 2.-A).

are in the most useful positions for the function of walking. The pelvis is on a transverse plane and the hips are abducted to favor the gluteal muscular mechanism which plays an important rôle in stabilizing the pelvis during the act of walking. The normal physiologic curves of the spine are

TABLE 2. — *Optimum Positions for Fixation When Return of Function is Anticipated (Infantile Paralysis, Bone and Joint Infection, Arthritis)*

Shoulder.
1. Abduction 90 degrees.
2. External rotation 45 degrees.
3. Anterior flexion (elbow in front of anterior axillary line).

Elbow.
1. Flexion 90 degrees.
2. Supination.

Wrist.
1. Extension 30 degrees (Dorsiflexion).
2. Neutral as to radial and ulnar deviation.

Physiologic position of grasp (wrist and hand).

Hand.
1. Fingers in semiflexion.
2. Thumb in position of opposition.

Spine.
1. Straight with the normal curves not exaggerated.

Pelvis.
1. Transverse plane.

Hip.
1. Abduction.
2. Neutral as to rotation.
3. Neutral as to flexion and extension.

Knee.
1. Straight with support under popliteal concavity.

Foot and Ankle.
1. Dorsiflexion 90 degrees.
2. Neutral as to inversion and eversion. Arches well supported. Toes side by side and extended.

preserved. The shoulder is abducted and the elbow is flexed for the purpose of favoring those muscles which must function against gravity. The wrist and hand are immobilized in the physiologic position of grasp with the thumb in the position of opposition and the fingers semiflxed. Failure to apply these principles results in the development of contracture deformities which cause partial or complete loss of function of the upper and lower extremities and the trunk as demonstrated in figures 2A and 2B.

Flaccid paralyses resulting from lesions of the peripheral nerves should be immobilized in the position of relaxation as demonstrated in figures 3A and 3B. Relaxation of partially paralyzed muscles facilitates restoration of function while stretching favors further paralysis.

Burns involving the axillary region should be treated with the arm abducted and externally rotated in order to prevent fixation of the arm to the thorax by scar tissue as seen in figure 4. Burns involving the ankle, knee, hip, elbow, wrist, hand, and neck should be immobilized in the optimum positions for the return of mechanical functions of the affected part.

Bowing of the extremities and disturbances of the normal weight bearing lines can be prevented during the active phase of rickets if the infant is immobilized on a Bradford frame or in a plaster-of-Paris spica and not permitted to be full weight bearing while the bones are pliable.

A child with infectious arthritis of the hip joint is not treated by mechanical rest if the affected extremity is permitted to assume the position of flexion and adduction. This position is one of instability and it is productive of spontaneous dislocation of the hip (fig. 5). The hip joint is in a state of mechanical rest only when the involved extremity is maintained in the position of extension and slight abduction which is the position of stability. In this position spontaneous dislocation can not take place.

Many patients with subdeltoid bursitis experience prolonged and unnecessary disability because the affected shoulder is not supported in the position of mechanical rest, abduction and external rotation, during the acute or early period of the disease. The important functions of abduction and rotation of the shoulder are usually lost

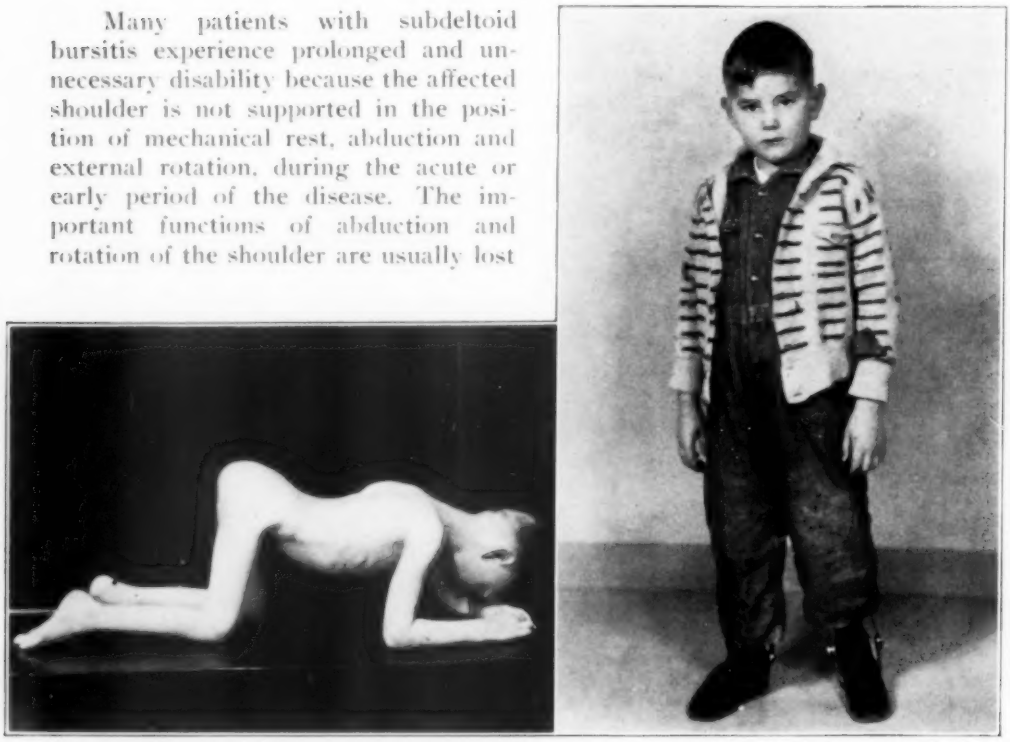
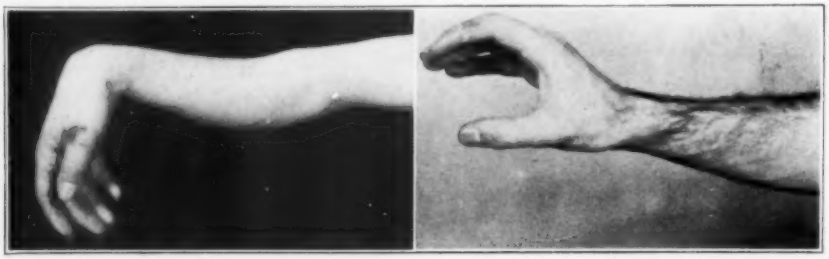


Fig. 2.-A. — Patient with residual paralysis of anterior poliomyelitis unable to walk because of fixed contracture deformities of hips, knees and feet. The boy had moved about by quadruped locomotion for a period of four years. The contracture deformities were preventable. B — Patient is ambulatory with long leg braces following mechanical and surgical correction of the contracture deformities of the hips, knees and feet.

if the arm is held in adduction while subdeltoid adhesions and muscular contractures are permitted to develop because of failure to apply the proper preventive physical therapeutic measures.

Deformity and loss of function of an anatomic part are frequently inevitable. Destruction and loss of function of the affected joint is the usual end result in joint tuberculosis. Gonorrheal arthritis, ankylosing atrophic arthritis, compound intra-articular fractures, and nonspecific joint infections not infrequently result in fibrous or bony ankylosis. Ankylosis of a joint may greatly or only slightly interfere with the functions of the apparatus of locomotion. The degree of disability depends upon the position of ankylosis of the affected joint. Loss of function of the hand is minimal and slight if the wrist is ankylosed in the position of dorsiflexion; but ankylosis of the wrist in extreme palmar flexion results in very marked loss of function



Figs. 3.-A and B. — A radial nerve neuritis with wrist and finger drop should be treated with the wrist and fingers supported in a position which places the paralyzed muscles in a state of relaxation.

Fig. 4. — Scar tissue web between arm and thorax complicating an extensive burn. Axillary burns should be treated with the arm supported in the optimum position for return of shoulder joint function (abduction and external rotation).

of the hand. Ankylosis of the hip joint in one position may force the patient to walk with the aid of crutches, while ankylosis in the optimum position may be associated with only slight disability. The positions of ankylosis which cause the minimum of interference with the functions of the apparatus of locomotion are known as the optimum positions for ankylosis (table 3).

The optimum position for ankylosis of certain joints varies according to age, sex, and occupation. The knee, during childhood, should not be ankylosed in flexion since with continued weight bearing the flexion deformity

Fig. 5. — Child with infectious arthritis involving multiple joints lay in bed for many weeks with the left hip held in flexion and adduction. Note that the hip joint dislocated posteriorly because the "position of instability" was not changed to the "position of stability" (extension and abduction) early in the course of the disease. Contracture deformities of the right hip, knees and feet were permitted to develop although they could have been prevented.

TABLE 3. — *The Optimum Positions for Ankylosis of Joints*

Shoulder.
1. Abduction.
   (a) Adult 45-50 degrees.
   (b) Child 60-75 degrees.
2. External rotation — 15 degrees.
2. Anterior flexion (arm in front of anterior axillary line).

Elbow.
1. Flexion 90 degrees with hand in mid-pronation. Ankylosis of both elbows — one slightly more and the other slightly less than a right angle.
2. Consider occupation.
3. Right or left handed.

Wrist.
1. Dorsiflexion 30-45 degrees.
2. Neutral as to ulnar and radial deviation.

Hand.
1. Position of grasp (altered by occupation).

Spine.
1. Position in which normal curves are slight. Slight forward flexion of head and neck to accommodate walking and reading.

Hip.
1. Adult.
   (a) Flexion 45 degrees (sitting occupation).
   (b) Flexion 15-25 degrees (standing occupation).
   (c) Abduction 5-10 degrees.
   (d) Neutral rotation.
2. Child.
   (a) Flexion 25 degrees.
   (b) Abduction 10-20 degrees.
   (c) Neutral rotation.
3. Consider.
   (a) Occupation.
   (b) Degree of shortening.
   (c) Age.

Knee.
1. Adult.
   (a) Straight — standing occupation.
   (b) Slightly flexed — sitting occupation.
2. Child Complete extension.

Foot and Ankle.
1. Plantar flexion 5-10 degrees (altered by sex and shortening of extremity.
2. Neutral as to inversion and eversion. Arches supported. Toes extended and side by side.

increases at the level of the epiphyseal discs. The position for ankylosis of the ankle varies in men and women because of the difference in the height of the heels of the shoes. The adult patient should always be consulted regarding his occupation before the position for ankylosis is definitely determined.

There are numerous mechanical agents which are used to obtain and maintain the optimum position of fixation. A great variety of metal splints, frames, braces, plaster-of-Paris supports, equipment for skeletal traction, skin traction, materials for internal fixation of fractures, bone grafts, pillow splint with side boards and many other physical agents are used. The most important point regarding each one of the agents of the above list is that it performs its proper function. Skeletal traction which maintains over pull of a fracture and separates the fragments may actually be harmful and cause the development of a serious complication or non-union.

Physical Therapy (Phase 3)

The principles included in phase 3 of the program of "mechanical and physiological rest" are generally grouped under the heading of physical therapy. They include numerous measures which favorably influence the physiology of the various tissues which control the mechanical functions of the apparatus of locomotion. Assiduous attention to these measures often de-

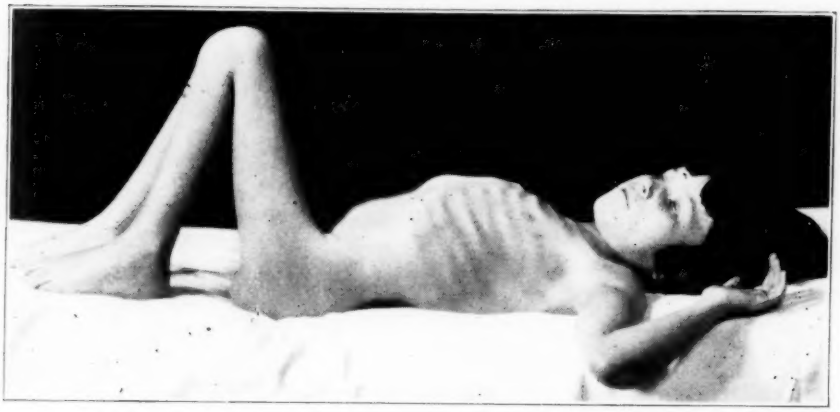


Fig. 6. — Patient with 90 degree flexion deformities of both hips complicating chronic infectious arthritis of the hip joints. A bilateral bivalved plaster-of-Paris hip spica would have maintained the optimum position of the hips if it had been properly applied early in the course of the disease before the development of the deformities.

Fig. 7. — Patient with bony ankylosis of the right hip in bad functional position complicating a gonorrheal arthritis. The optimum position for ankylosis of the hip could have been maintained by the application of a plaster-of-Paris hip spica during the acute stage of the arthritis.

termines the success or failure of treatment. The integrity of the circulatory, neuromuscular, and articular systems may be maintained in the presence of disease and injury if mechanical and physiological principles are adequately applied. These measures are conveniently outlined (table 4).

Stiff and useless fingers should not result after proper treatment of a Colles' fracture if the patient is instructed actively and completely to extend and flex the fingers several times daily while the fractured part is splinted.

TABLE 4. — *Physical Therapy*

I. The normal stimuli of function.
  A. Active muscular contractions.
    1. With joint movements.
    2. Without joint movements.
      Muscle setting exercises.
    3. Assisted.
    4. Unassisted.
  B. Weight bearing.
    1. Partial.
    2. Full.
II. Heat — Induced fever.
  A. Local.
  B. General — systemic.
III. Cold.
IV. Elevation.
V. Massage.
VI. Passive motion.
VII. Heliotherapy.
VIII. Occupational therapy.
IX. Under water gymnasium or therapeutic pool.
X. X-ray and radium therapy.
XI. Electrotherapy.

The same patient will not lose the functions of abduction and the rotations of the shoulder on the affected side if he is instructed actively and frequently to place his hand behind his head and lower back while the Colles' fracture is immobilized. These principles are expressed in a phrase which may be applied to most fractures — "actively mobilize the muscles while the fractured bone is immobilized."

Muscle setting exercises or active contractions of skeletel muscles without joint movements are highly desirable in order to maintain muscle tone, to prevent muscular atrophy and contractures and to maintain the integrity of the neuromuscular and articular systems. Several days after surgical treatment for internal derangements of the knee joint, the patient is instructed actively to contract the quadriceps muscle. Subsequent knee joint function depends upon the integrity of the extensor apparatus of the knee joint. Many patients with various derangements of the knee joint experience continued disability, subsequent to surgical treatment, because the quadriceps mechanism is not reeducated and quadriceps insufficiently remains.

Patients with chronic osteomyelitis of the femur and tibia too often present a stiff knee joint because the entire extremity is immobilized in a solid plaster dressing for many weeks or months without any measures to preserve knee joint function. Muscle setting exercises during the period of splinting and active motion of the knee joint once daily will prevent disability of the knee joint. Neglect of phase 3 in the program of treatment of osteomyelitis is responsible for many preventable deformities. Uninterrupted and continuous fixation of the entire extremity during a period of many weeks subsequent to surgical treatment for osteomyelitis of the tibia or femur is not physiologically sound. Knee joint function and the normal physiologic state of the soft tissues which control the mechanics of the knee should be preserved by proper application of the principles of phase 3 during the period of fixation.

A patient with a traumatic fracture — dislocation of the shoulder — was recently observed by the writer. Manipulation under general anesthesia reduced the dislocation and replaced the greater tuberosity to its normal anatomic position so that mechanical rest was obtained. The affected extremity was immobilized in the optimum position anticipating normal return of function. Phase 1 and 2 of the program of "mechanical and physiological rest" as applied to this patient were properly executed. Phase 3, however, was entirely neglected during the period of immobilization which lasted

for six weeks. It is now nine months since the original injury, and the patient is still attempting to reestablish function which could have been secured during the phase of immobilization if the principles of phase 3 had been adequately applied.

A child with residual paralyses of anterior poliomyelitis may be able actively to contract, exercise, and develop partially paralyzed muscles under water but out of water the same muscles could not function against gravity and the weight of the extremity. Septic joints, hand infections, osteomyelitis, paralyses, fractures, and other conditions affecting locomotion will often show remarkable improvement if treated under warm water at the proper time during the therapeutic program. The heat stimulates the circulation and the buoyancy of the water relieves much of the weight of the extremity and gravity; as a result active motion is accomplished with less muscular effort and pain. Patients with atrophic arthritis should not have the affected joints immobilized continuously during an acute or subacute manifestation of the disease. Once or twice daily the joints should be mobilized by active, assisted motion under warm water in order to prevent the development of contractures and adhesions. If there is radiographic evidenc of joint destruction and ankylosis is imminent, then it may be necessary to sacrifice motion but joint stability should be preserved by fixation in the optimum position for ankylosis.

The normal stimuli of function, active contractions of skeletal muscles, active motions of joints and weight bearing should be considered as physical therapeutic agents. Gaenslen, of Milwaukee, has stated that, "of the many varieties of physical therapy, active exercise probably deserves first place because of its wide applicability and because it calls into play the entire neuromuscular units in a manner approaching normal physiological action." Their source is limited to the patient himself and so frequently they are the very measures which are indispensable if function is to be preserved and deformity prevented. Other physical measures such as massage, heat, cold, elevation, heliotherapy, occupational therapy, induced fever, radiation therapy, and the hospital therapeutic tub or underwater gymnasium may be valuable aids in the therapeutic program. Patients often state that they receive "light treatments and exercises" at a doctor's office once or twice a week, but that no "home treatment" was advised. Simple physical agents such as the hot or cold turkish towel, hand, foot and tubs baths, woolen kneelets, swimming, sewing, active exercises by games which demand the use of certain muscles and joints, ladder, trapeze and other gymnastic measures, weights attached to the wrist, mirror exercises, crawling up the wall with the fingers aided by small strips of boards attached to the wall in the form of a ladder, drawing, writing and numerous other exercises, which stimulate an active cooperation and interest of the patient are useful methods if properly introduced in the program of treatment.

The purpose of this paper is not to consider the details of management of any one of the stages of treatment of the many disorders of locomotion, but to present a general outline of the program of therapy which will tend to diminish the number of preventable surgical tragedies.

The three phases of the program of "mechanical and physiological rest" and the numerous principles implied in each should guide the clinical course of all patients suffering with disorders of the apparatus of locomotion. Members of the medical profession who treat diseases and injuries of bones and joints should recognize that although the various tissues of the motor system of the body are separate anatomic structures they must be considered as a single physiologic unit if function is to be preserved and deformity prevented.

Conclusion

The writer has attempted to emphasize the meaning of the term "rest" as applied in the treatment of injury and disease of the apparatus of locomotion. Proper application of the fundamental mechanical and physiological principles of "rest" will prevent numerous deformities and diminish the number of surgical and medical complications.

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(*For discussions of Dr. Hart's paper turn to page 92.* — ED.)

PREVENTION OF DISABILITY IN FRACTURES*

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To understand the disability that may follow a fracture it is necessary to consider both the underlying factors and the treatment. A certain degree of incapacity must always be expected. It is the particular responsibility of those undertaking the care of fractures to keep that period as brief as possible, to promote recovery in the shortest time possible, and to prevent, as far as can be, any permanent defect. The factors that play a part in attaining this objective may be considered from two standpoints:

1. Proper general management.
2. Conduct of actual treatment.

General Management

It is generally recognized that fractures should be treated by especially qualified orthopedic, industrial, or general surgeons. The direction of the entire course of treatment should rest in the hands of one surgeon. The responsibility of primary reduction and *effective aftercare*, rests with the surgeon, it cannot be relegated to an assistant.

The American College of Surgeons, through its Fracture Committee, has made recommendations and suggestions for the improvement of hospital organization to accomplish a satisfactory "Unity of Control." One of the few comprehensive reports and investigations upon this particular phase of the problem is that of the Committee on the Treatment of Fractures of the British Medical Association. After a survey of conditions under which fractures are treated in England it was found that unduly prolonged disability was due to —

1. Inadequate organization of fracture service.
2. Imperfect surgical treatment.
3. Non-medical causes.

In its conclusion the assertion was made that there are four cardinal principles which underlie successful fracture treatment:

a. Segregation of hospital cases under one surgeon or group of surgeons, thus enhancing their skill and training.

b. Continuity of treatment.

The fracture unit staff must be responsible for the treatment of the pa-

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 10, 1935.

tient from the primary reduction to complete restoration of function — which includes physical therapy, and all remedial measures.

c. Satisfactory aftercare.

d. Unity of control. Not merely expert supervision but supervision by one expert, until recovery from the injury is complete. Segregation, continuity and after-care achieve their greatest value only if there is unity of control.

This conclusion accordingly implies that one of the major causes of prolonged incapacity following fracture may lie in a lack of continuous supervision by the responsible surgeon. The main essential to prevent untoward consequences is "Unity of Control."

Conduct of Treatment

Fracture disability may be increased by the following five factors:

1. The particular type and location of the fracture, e. g., the neck of the femur,
2. Age of the patient,
3. The extent of the concomitant injury, particularly to the muscles and nerves,
4. Infection in open fracture,
5. Character of treatment.

It is obvious that in the aged, in extensive injuries with multiple fractures, open wounds, and laceration of the soft tissues and nerves, it may be necessary to make the best of a bad situation, that is to say, some disability cannot be prevented. But in the treatment of an open fracture and in the planning of the reduction and routine aftercare of simple fractures is particularly to be found the field where much can be accomplished to obtain an early satisfactory functional result and prevent disability.

The open fracture problem is not the concern of the physiotherapist but the procedure of reduction and aftercare would seem of paramount interest.

Features of treatment that have an immediate bearing upon the prevention of undue incapacity, consist of —

1. Immediate reduction — first-aid traction.
2. Adequate supervision of the immobilization apparatus.
3. Early physical therapy.
4. Active cooperation of the patient in measures to regain function.
5. Occupational therapy.
6. Ambulant treatment — adequate protection of the site of fracture.

Immediate reduction or traction not only makes the reposition of the fracture easier but minimizes trauma and avoids prolonged hemorrhage into the soft tissues by the displaced fragments and thus promotes earlier return to normal of damaged muscles, and the quickest possible return of muscle function.

Prompt and proper first-aid traction is an important factor in rapid recovery and avoidance of disability, as Kennedy has convincingly demonstrated. Reduction must be not only immediate but sufficiently accurate, and this final accurate position should be obtained at the first reduction or, when traction is used, in the first 24 hours. When late reduction is forced upon the patient or surgeon, increased incapacity is likely to result.

After reduction each fracture will present its particular recovery problem. The means at our disposal to meet that problem should be flexible. No definite routine should be fitted to every fracture.

Adequate supervision of immobilization apparatus. — As experience in the treatment of fractures widens, the conviction becomes certain that, no mat-

ter what the method of immobilization may be, constant supervision is imperative. Traction methods are potential trouble breeders, but casts and molded plaster splints cannot be ignored. The motion within or loosening of a cast and the slipping or loosening of splints may cause angulation or change in position of the fracture fragments that may lead to increased disability. Daily observation to prevent pressure areas, should be the rule for at least the first ten days, with frequent radiographic checks on the original reduction, lest the unsuspecting surgeon be faced with a fracture deformity or displacement when its correction may be difficult. The patient should be seen sufficiently often, likewise, in the ambulant stage.

Early physical therapy. — Traction methods in treating fractures and molded plaster splints have been particularly favored because with them physical therapy may be begun almost immediately. Modern treatment is based on the realization that the solution of the fracture problem lies in two almost equally important parts: (a) adequate reduction and reunion of the fragments; (b) return of function.

Satisfactory reduction of a fracture in itself does not guarantee normal recovery. Efforts to regain function must not be reserved for those fractures that present difficulties after the period of immobilization has passed, but must be used early and routinely in all fractures, with but few exceptions. Measures must be directed toward regaining function in muscles and joints. To regain function, or retain function, some motion, however slight, must be possible. In fractures, particularly about the joints, immobilization for reduction may prevent motion. Personally, I am rather cautious in the removal of the retention apparatus to obtain motion in joint fractures, but very often slight motion in the joint can be obtained without removal of restraint, especially with traction reduction, or by *partial* removal of support — half of a cast, or one of two molded splints. Motion may be obtained either by active efforts of the patient or by passive measures. Active motion by the patient himself far outweighs in importance and efficacy any movement obtained by an external agency. Passive motion, except to guide the voluntary efforts of the injured, should be relegated to the exceptional case that in the last stages of treatment still presents deficiency in function. The major problem of after-care, then, to prevent disability after the fracture proper has been satisfactorily dealt with, is to obtain active motion in muscles and joints.

Immediately following a fracture there is contusion and laceration of the adjacent soft tissues and often muscle spasm, which causes pain and prevents active motion. It is then (early, not late) that physical therapy can be of greatest use. Very light stroking massage should be given to the traumatized soft parts as soon as possible after reduction, together with gentle stimulation of the muscles by the faradic current, such as is obtained by the Morse or Bristow coil, a myoneurostat, or the sine wave. Daily treatments should be continued until full, active function is attained. It is particularly emphasized that these measures merely assist and aid early active motion by the individual himself.

Active cooperation of the patient. — The primary consideration is the injured man, his psychologic reaction to his injury and treatment, and the absolute need for his participation in the treatment. This is the most important element in a satisfactory and normal recovery. There is often a tendency for him to assume an attitude that it is the surgeon's job to get him well. The plan of treatment, therefore, should be outlined to the more intelligent patient in order to obtain his cooperation so far as possible. Those with a fear or anxiety complex need sympathetic and understanding supervision to obtain satisfactory progress, as once this complex is established it is exceed-

ingly difficult to overcome. "The medical man" — and this should include every medical attendant; not only the surgeon, but also the physical therapist and any assistant — "must try to discover and constantly to recognize the exact mental attitude of the patient. This includes resentment at the injury, apathy, desire for compensation, fear of pain, keenness to get well, etc." (Hertzler). His confidence must be gained in the methods and apparatus employed; he must be convinced that rapid recovery of function depends on him, and that physical therapy and massage are but adjuncts to help him help himself.

Early active motion must be inaugurated as soon as possible and encouraged in every way. Though traction-suspension methods are preferable, even the systematic exercise of fingers and toes of extremities in casts or splints will be of material benefit. Permitting a patient to wear a cast until the full time for union has elapsed and having him make no effort to move the injured part is a violation of physiologic rationale. Daily instruction in and test of muscle use should be practiced. Early indications of the return of function and of favorable developments must be pointed out. Every gain in range of motion and strength should be openly commended and if deformity, such as excess callus, occurs, it is important to inform the patient that deformity does not necessarily mean disability. In the detailed acquisition of active motion, Cotton has pointed out that "The Physical Therapist is of vast use in two ways —

1. "In devising exercises that are easy, utilizing gravity instead of fighting it — exercises that the patient can learn to do with precision, exercises that risk neither loosening of a recent union nor overtiring the muscles.

2. "In making him do them at home as well as in the office. In making him work himself."

Occupational therapy. — After function has been somewhat restored, occupational therapy plays an important rôle. Hinton has shown rather strikingly that occupational therapy which takes full advantage of active motion is far more effective than massage or passive motion. Boehler advocates no passive motion but early ambulation, use, and active motion. Murray favors "the increasing use of exceedingly varied and adaptable occupational therapy as the essentially logical after-treatment for the regaining of function, with physical therapy as an adjuvant." In studying the metabolism of massage, Cuthbertson points out that though, as a result of direct stimulation, it accelerates anabolic processes and causes diminished elimination or the highly to be desired retention of nitrogen, sulphur, and phosphorus in the tissues — probably in muscle and bone — active motion produces even a greater retention of these products. In other words, active voluntary effort of the injured is demonstrated physically and chemically to be the greatest beneficial factor aiding recovery of the tissues as well as the regaining of muscle strength and function.

Early return to work has much to recommend it, particularly if a "doubting Thomas" can be put on a job in the same environment in which he worked before. His mind is not only concentrated on work to be done, but he begins to use the disabled member by normal or natural movement incident to work, and thus obtains a quicker recovery of function than by periodic physical therapy. In other words, a real occupational therapy is substituted for prescribed occupation therapy. If work can be done, or if a man is employed and draws pay, the fear of permanent injury or incapacitation and the likelihood that the lesion may end in any degree of disability, may be held in abeyance or totally avoided. Attention is no longer centered on the accident and its consequences but on the need to speed up treatment

and to cooperate until full function has been regained. Many of the neuroses of injury may be thus avoided and incapacity shortened.

Certain injuries, however, do not lend themselves to rapid return to work, notably: (a) head trauma, (b) extensive thoracic lesions, (c) fractures of the foot in which weight-bearing parts are involved. In some states injured coming under the Workmen's Compensation laws cannot be put at work until they are cured or their case settled. Early return to work, therefore, cannot be considered a blanket formula but must be judiciously and individually employed.

Ambulant Treatment and Late Protection of the Site of Fracture. — Ambulant treatment in fractures, especially of the lower extremity, is a form of active motion that can be highly recommended. The early active use with weight bearing seems to hold an advantage in obtaining rapid return of function over other methods. It should be used with due precaution and appreciation of its limitations and the possibility of pressure complications.

Certain types of fracture unite slowly, or callus formation may be slow or insecure. As these are particularly in the lower extremity, either at the neck of the femur or in the lower third of the tibia, some protecting or supporting device will be necessary to be ambulant and to avoid prolonged disability. Occasionally, molded plaster splints are sufficient but more often some form of brace or walking caliper will have to be used. This need not delay return of function, as in selected cases resumption of work can be permitted before firm union is obtained. One of our cases, a fracture of the tibia, was back at his job two years before union was considered sufficiently strong to permit discarding a brace. All such, however, must remain under supervision so that late bending deformity or angulation does not occur. Physical therapy can be continued if deemed advisable. It must be remembered that the responsibility of the surgeon and his staff not only holds for satisfactory and adequate primary treatment but continues until the injured person has a maximum return of function and a healed fracture, even though he may be back at work.

Conclusion

Prevention of disability in fractures depends largely upon the magnitude of the original injury, its location and the extent of the concomitant injury to muscles, nerves and blood vessels, and in open fracture upon the prevention of infection.

In the conduct of the treatment there should be unity of control. The surgeon must be in active command of both reduction and after-care until functional recovery is complete.

Much to prevent prolongation of disability may be accomplished by immediate reduction and first-aid traction; supervision of the immobilization apparatus; early physical therapy; active cooperation of the patient; occupational therapy; and ambulant treatment.

The greatest essential next to accurate reduction is to enlist, acquire, and encourage the wholehearted cooperation of the patient to obtain restoration of function by his own active effort; in this physical therapy plays an important rôle.

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(For discussions of Dr. Estes' paper turn to page 92. — Ed.)

HALLUX VALGUS: POSTOPERATIVE PHYSICAL THERAPY *

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Hallux valgus, congenital or acquired, is a deformity that brings no comfort to anyone and much disability to many. It is always associated with, and actually a part of static disability of the feet.[1] Its correction is essentially surgical, with intelligent aftercare as the *sine quo non* for a successful result. The deformity is primarily bony, the phalanges of the great toe being abducted toward the lateral side of the foot. Soft tissue changes promptly follow and must be considered and cared for in any proposed method of treatment. As the great toe leans toward the second toe, the metatarsal head is pushed toward the medial side of the foot, producing the prominence which soon becomes traumatized by the shoe, resulting in a thickened bursa over the metatarso-phalangeal joint, commonly known as a bunion.

With increasing abduction of the great toe, the powerful tendon of the extensor proprius muscle becomes displaced laterally and shortened, establishing a vicious cycle, for the shorter the tendon the greater the deformity of the toe and the greater the abduction of the toe, the shorter the tendon. The toe may lie on top of one or more of the adjoining digits or it may lie beneath them. A frequent complication is hammer toe of the second digit. Always there is associated with this aggregation of pathologic changes flattening of the metatarsal, or transverse arch of the foot.

Surgical Treatment

Operative procedures of various types have been employed with varying success. Any contemplated treatment must purpose to: 1. Restore the abducted toe to normal position and hold it there. Some sort of shortening of the metatarsal will be required. 2. Lengthen the extensor proprius tendon. 3. Restore to usefulness the damaged soft tissues. 4. Support the flattened arches by appropriate appliances. I believe that the dissatisfaction expressed by some patients as to the outcome of operative correction is due to failure to attend to one or more steps of the treatment. An important feature to be remembered is early mobilization and restoration of function.

Arthroplasty upon the deformed metatarso-phalangeal junction as described by Mayo[2] is probably the most widely known. It was later described in detail by Henderson[3] in 1915, at the annual session of the American Medical Association. His excellent paper with the delightful frank and divergent

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 10, 1935.

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expressions of the men discussing it give a good idea of the widely varying opinions held and technics employed by equally competent surgeons. In my own opinion, the bursal sac is frequently too thin to be of use, or too thick and indurated to be safe for placement within a joint cavity.

Cuneiform osteotomy of the shaft of the metatarsal requires additional section of exostoses at the distal joint. The greatest objection to osteotomy, however, is the length of time required for resumption of function after the surgical fracture. It also necessitates accurate immobilization of the foot and toe.

Removal of the sesamoid bones has been acclaimed as a simple and efficient procedure.[4] It is obvious that there must be also a lengthening of the extensor proprius tendon. Removal of sesamoids is attended by considerable risk of damage to the flexor brevis tendons in which they are situated. Also I challenge anyone to correct the deformity shown in figure 5 by any such operation.

Preferred Technic

Resection of the metatarsal head as set forth by Heuter back in the 1860's and cited by Holmes[5] is the basic principle to which many of us have returned, insofar as the actual bone section is concerned. Semi-elliptical incision is made over the metatarso-phalangeal joint, with the curve toward the dorsum of the foot. Incision extends through skin, subcutaneous tissues and periosteum to the bone. The entire flap is dissected plantarward until the head of the metatarsal is fully exposed. With a duck billed costotome the major portion of the metatarsal head is removed, taking care to incline the instrument to leave the weight bearing portion of the plantar surface of the head of the bone and also to remove more of the medial than the lateral

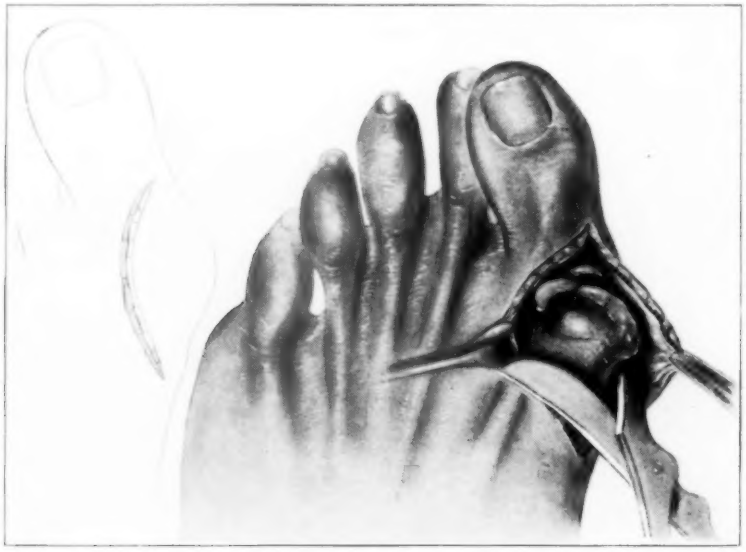

Fig. 1. — Resection of head of metatarsal. Costotome placed with obliquity in two planes, from lateral to median and from dorsal to plantar surfaces. Line of incision shown in inset.

aspect (fig. 1). These precautions will preserve the weight bearing function of the toe and throw it into correct position. Any remaining exostoses are removed by chisel or trimmed with rongeurs while rounding off and reshaping the distal end of the metatarsal. It is rarely necessary to cut away any bone from the phalanx. The concave surface of the proximal phalanx, cov-

ered as it is by cartilage, will permit the joint to function without interposition of fascial flaps.

Lengthening of the extensor proprius tendon is the second and equally important step. It is readily exposed through the original incision for a distance of about two inches. Fractional "Z" incision is made in the tendon, taking care not to complete the long arm of the cut, but to stretch and shred the fibres between the two limbs of the incision (fig. 2). Lengthening

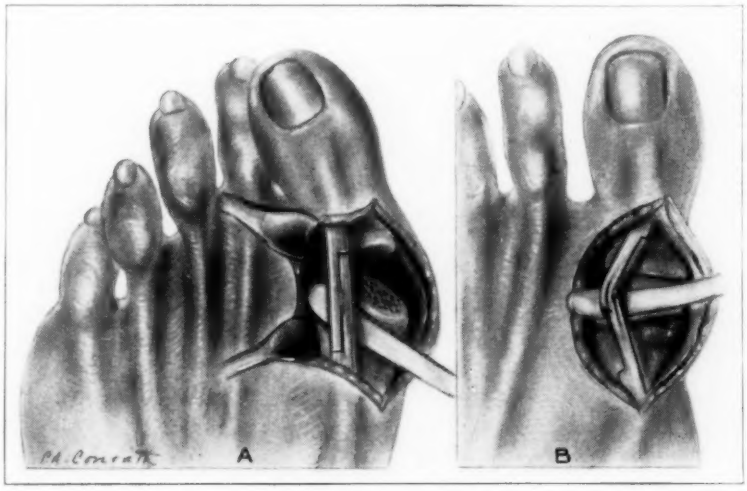

Fig. 2. — Lengthening of extensor proprius tendon. (a) The long arm of "Z" incision is not completed, leaving fibres to be stretched or shredded. (b) Elongated tendon sutured with fine silk.

of one-half to three-quarters of an inch suffices, when the ends of the sliding sections of tendon are sutured with two to four strands of fine silk. The wound is accurately closed in layers, including the bursa and thickened skin. The latter will take care of itself, once the primary bone deformity is corrected. (figs.3-5).

Fig. 3. — Severe bilateral hallux valgus of long standing in a white woman.

Fig. 4. — Patient shown in figure 3 four months after operation. Normal, healthy skin and contour, after receiving contrast baths, baking, massage, and exercises. Excellent function, wearing carefully fitted supports for the arches.

A dressing of light gauze and a goodly sized gauze roll between the first and second toes are held in place by narrow adhesive strips. Larger dressings are cumbersome and interfere with early mobilization of the feet.

Fig. 5. — Man, 57 years of age. Extreme hallux valgus with overriding of great toe. The shortened tendon of the extensor proprius hallucis may be seen as it stands out to hold toe in position of deformity.

Fig. 6. — Patient shown in figure 5, one month after operation. Moderate shortening of toe. Some delay in healing of incision on left foot. This man returned to his wanderings as a "knight of the road," hence later photograph was not secured.

A hoop over the feet to keep bedding from pressing on the toes is important. The dressing is not changed until the time to remove sutures, if nonabsorbable material has been used. A routine time schedule is "one week in bed, one week in wheel chair and one week limping about." The second and third periods are usually shortened.

Physical Therapy

Physical therapy is instituted during the third week. Felt pads cut to support longitudinal and transverse arches are placed in large shoes or slippers and the patient is encouraged to walk as much as is comfortable. More strenuous exercises must wait until the lengthened tendon has firmly reunited, during the fourth and fifth week.

Hydrotherapy is not new in the treatment of this condition. In 1878, prior to the advent of aseptic surgery and modern physical therapy, Hamilton,[6] of New York, described resection of the first metatarsal and recommended "no dressings and no sutures," using hot water baths, 95 to 100 degrees F. beginning as early as six hours after operation and continuing for a week. He found it helpful in giving "immunity to inflammation and other accidents."

In modern treatment we prefer to wait for healing of the wounds before instituting contrast baths, consisting of three minutes in hot water and one minute in cold, repeating the procedure four times as a single treatment. Such treatments are given daily, followed by gentle massage. The alternating expansion and contraction of the capillaries induced by the heat and cold give real circulatory gymnastics.

The "Whirlpool Bath" as used by Ewerhardt affords a better and easier treatment. Feet immersed in the violently swirling water of such a tub

receive hot or cold water as desired with the stimulating effect of massage secured from the intermittent pressure of the whirling water. This is, of course, not available in the home and not always found in the surgeon's equipment. Infrared or other form of baking may be used and followed by an electric vibrator or even the sinusoidal current.

Exercises used are essentially those for strengthening the weakened musculature of flat feet: Flexion of toes, adduction of the forefoot, circumduction of the entire foot. It is well to plan definite sets of exercises to be taken at least twice daily until the patient is able to walk naturally without fatigue.[7] Exercises are to be done slowly and forcefully, not in the form of rhythmic exhibitions of motion, but as deliberate employment of muscle groups, contracting muscle fibres, holding the contraction, relaxing and then repeating.

Movements against resistance are used as early as it is deemed safe for a recently healed tendon and fascia. As soon as tolerated, usually in the fifth or sixth week, cork lifts on insoles are substituted for the felt pads in the shoes. The patient is encouraged to take regular walks of increasing range from the 10th to 14th postoperative days. Habits of pedestrianism soon accomplish more than sets of gymnastic movements.

Summary

1. Hallux valgus as a disabling deformity has been recognized for many years.

2. Treating requires surgical correction and physical therapy of the static disability of the feet.

3. Oblique resection of the head of the first metatarsal leaves sufficient weight bearing base for this point of the foot tripod.

4. Lengthening of the tendon of the extensor proprius hallucis is essential to permanent cure in most cases.

5. To secure complete restoration of function, early mobilization must be instituted and followed by systematic physical therapy in the form of active exercises, hydrotherapy and massage.

6. The associated foot strain must be supported by appropriate shoes and fitted supports.

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Discussions of Drs. Hart, Estes and Brookes Papers

Dr. L. V. Parmley (Little Rock, Ark.): The part of Dr. Hart's paper which strikes me forcibly is in which he asks a question and then proceeds to answer it logically and detailedly. The majority of us ask ourselves, in planning the treatment, "What conditions am I likely to encounter during the course of treatment of this case?" Dr. Hart begs of us to ask ourselves, "What conditions must we prevent during the course of the treatment of this case?" I cannot hope to enlarge upon the essayist's discussion of this question, but I desire to emphasize that part of his paper, together with his recommendations, to circumvent the conditions and complications with which we are all familiar.

I agree with Dr. Hart that we have now at our disposal so many complicated methods and types of apparatus, both for internal and external fixation, that we are prone to lose sight of the more simple and conservative measures. I agree with him, also, that active movement is of more value than all other methods and devices put together as a matter of physical therapy.

Dr. Estes stressed early physical therapy in the treatment of fractures and reminds us that satisfactory reduction of the fracture alone does not guarantee normal recovery. Neither does early physical therapy, or anything else for that matter. I am one of those who has suffered the pangs of keen disappointment after having followed what I thought, and what is generally considered to be, highly proper methods throughout all phases of the treatment of a fracture, only to find myself in the end dealing with a bony ankylosis, or deformity of some type.

No doubt some of us become overenthusiastic about early physical therapy and employ the various methods too early. With some surgeons I know it is a hobby. My father used to tell me that a surgeon who rides a hobby as a method of treatment is a surgeon to beware of, for he is likely to allow his hobby to override his better judgment. As I grow older, I am inclined to agree with him. I agree with Dr. Estes when he says, "I am rather cautious in the early removal of retention apparatus to obtain motion in joint fractures."

I am exceedingly glad he has emphasized the matter of active cooperation of the patient, and I think we all agree with him that it is a most important element in obtaining a satisfactory and normal recovery. It merely requires a little extra time in visiting the patient during the morning rounds to explain how thoroughly important it is for him to assist us. Moreover, it instills the idea in his mind that, after all, he must assume part of the responsibility for his recovery. The surgeon who occasionally visits with his patients will often find himself obtaining much better results than the brilliant surgical mechanic who rushes in, observes the apparatus, issues a few tart instructions to the intern or nurse and then rushes out again. It is not necessary for us to make changes constantly in minor items of treatment to convince the patient that we haven't forgotten him, but occasionally it is necessary to convince him that we are human beings and not automatons solely interested in broken bones and large fees.

Dr. Brookes has described for us his operation for hallux valgus. He went into more detail about physical therapy than I thought could be given a patient for that condition. I am not in a position to discuss his paper and his operation as thoroughly as I should, because I haven't had the experience with hallux valgus that he undoubtedly has had, or that many of you have had, but I am inclined to think we are continually making the operation for hallux valgus more complicated all the time, and giving what is more or less a simple condition, at least generally considered so, rather more thought and work and energy than is required. I can't help but think that, because either I have been very, very fortunate in my few cases of hallux valgus or else I don't know much about it.

Dr. F. H. Walke (Shreveport, La.): Dr. Hart above all things notes that where disease is prevalent, rest is one of the most important features of treatment. I don't know of a disease of any kind that rest within certain limits wouldn't help. In my student days I recall one of my professors jokingly saying, "First, get your patient and then put him to bed." Of course, that meant rest with capital letters. From the surgical viewpoint, we find that in fractures, above all things mechanical and physiological rest is necessary. That is done in many ways, and probably in too many ways with the traction apparatus that we have today.

The simplest way we can reduce a fracture and fix it is the best. For that reason it is not necessary always to have all the complicated splints. Remember that the strong muscles pull against the weak, and we have to determine which muscles pull against each other. For that reason we have to fix our traction in the direction of the pull or resistance. Again, it is the duty of the surgeon to reduce the fracture so it will be as normal as possible, to try to restore anatomical parts as best we can, and then maintain them in an optimum position until healing is complete.

We ought to have several x-rays to check up. I know I have sometimes put on a cast, especially on the lower extremity, in my younger days and didn't make any check-up, and then about the time the cast was removed found a most embarrassing situation. Frequent x-rays are necessary for this check-up.

Mechanical rest, a principle as old as the essayist said it was, is something we must not lose sight of. I think anyone doing surgery certainly knows the mechanical and physiological reasons for it, and therefore I believe that should be constantly in our minds.

Dr. Estes' paper on fractures is of especial interest to me, because I believe he has had the same experience I have had. He is with a steel company, and I am with an oil company. Oil wells and derricks blow up, and we get all kinds of injuries and fractures as he gets them in the steel industry. One who sees the fractures first is almost the responsible party, if he reduces it and puts on a proper splint. We have our first aid corps in the field that does very nice work. They reduce and have lots of splints to pull fragments in place, and then transport an individual with a fracture very comfortably to the hospital. Then we reduce that fracture as quickly as possible, because we want to prevent any hemorrhage or hematoma that develops with it, trauma against nerves or pressure against the

structures of the softer parts. The quicker a fracture is immobilized the better. Proper immobilization means a proper splint for each particular case. You can't take any one splint and make the fracture fit it. That is my objection to a lot of the apparatus on the market.

Immobiliaztion must be maintained long enough. We check up by x-ray and find the callus formation around that as a good indication of healing. Realizing the seriousness of fractures of the femur, I have often taken off the splint and found the fracture non-united. Again I have allowed the patients to be about, and the first thing I knew the fragments were out of line again and we had much trouble and embarrassment.

As soon as adequate callus has formed, physical therapy is certainly indicated for many reasons. Only three physical agents are applicable. They are thermal, chemical and mechanical. If there is calcium deficiency, ultraviolet body irradiation has great value for its photochemical properties. Massage, electrotherapy, exercise, and hydrotherapy provide the mechanical features indicated in the average fracture during convalescence. Do not apply these measures too soon and at the same time don't immobilize too long.

Cooperation of the patient is absolutely necessary. We don't want him to develop a traumatic neurosis, because superimposed on an injury it produces a chronicity beyond the control of therapeutic measures.

Dr. Frank H. Ewerhardt (St. Louis, Mo.): These three papers deal with disabilities induced by forces operating from without the body structure, although congenital anomaly and static disability are mentioned as contributory factors. Similarly, both prevention and correction of the attendant disabilities demand the use of extraneous means. Such outside aids must in no case ignore the intrinsic forces within the patient's own economy.

Dr. Hart speaks convincingly of mechanical and physiological principles. I like his coupling of the two. I think we must remember individual variations in physiologic normalcy. In treating a fracture of the tibia in an individual with bowlegs, Dr. Estes would consider it poor surgery to manipulate that limb into esthetic alignment unless the other limb is also to be artistically treated. The employment of active motion in the treatment of fractures as soon as mechanical conditions permit cannot be overemphasized. This brings into play muscle reëducation and circulatory gymnastics. It reëstablishes the individual's psychologic confidence in himself and his damaged tissues.

Dr. Brookes speaks of pedestrianism, a forgotten art in the days of modern transportation. Not only modern shoes but modern pavements, hospital floors and hardwood floors in homes conspire to set at naught the elaborate mechanism nature has provided for the maintenance of normal foot architecture and the propulsion of body weight. I have on previous occasions spoken on the need of more yielding and irregular surfaces for walking as a therapeutic exercise in static disabilities of feet, limbs and trunk. The greensward of city park or lawns are far preferable to gymnasium floors and concrete walks. If one could only find an ancient cinder path or broken down brick pavement or even an old board walk for his daily stroll, the musculature of feet and back would be put to work in far more satisfactory fashion than by plodding along on perfectly engineered granitoid sidewalks.

Dr. J. C. Elsom (Madison, Wis.): Dr. Hart mentions mechanical and physiological rest. It is very important, indeed, as we all know. Dr. Estes mentions exercise, which again is very important. So it seems to me that the fine points in the armamentarium of the physical therapist is to know just when to exercise and when to give rest; when to go and when to stop. That is the important thing. When we learn that, we really will have added much to our knowledge of the treatment of the disorders, about which we have heard this afternoon.

I am sure that if our predecessors in medicine and surgery, men who worked perhaps fifty or seventy-five years ago, could have heard these papers, some of them would turn over in their graves, because the skillful surgeon considered from the standpoint of those old days was the man who immobilized the limb very thoroughly and put on a cast and left it on absolutely without any motion whatever for six or eight weeks, and considered his job well done. Perhaps he got anatomic results, but we know he did not get functional results.

We have come to a great change in our treatment of fractures. The old doctors, I think, left the restoration of function to the patient and to the Lord, and perhaps neither one of them did a very good job because there was slow convalescence and often permanent disability, and much of the time this disability was avoidable.

I agree with the essayist in the importance of early active exercise, but not too early. I agree also with the stress that has been made on active rather than passive exercise, because the patient himself in doing his active exercise knows when it hurts, and pain, as we all know, is nature's demand for rest. Excessive fatigue also is nature's demand for rest. So in all these cases I think we should not produce pain by artificial movement given by an operator, and we should never overtax the strength of the muscles.

Dr. Estes has emphasized the fact of the mental satisfaction that comes to the patient when he sees he can move his fingers and toes because, after all, we know of the profound influence of the mind over the body.

Dr. Estes says occupational therapy is a logical form of treatment with physical therapy as an adjuvant. I think occupational therapy is physical therapy, because we make use of purposeful and in-

teresting activities. After all, exercise is physical therapy. We know that function makes structure an important thing we must always remember.

Dr. Estes mentions injuries which do not lend themselves to rapid return to work, and I think he lists them as head trauma, thoracic injuries, and fracture of the foot. I think perhaps we should also add injuries to the back, because we know of the psychic disturbance which so often occurs in those injuries and how they continue on and on, especially if the patient is receiving compensation.

We must also remember the variation in the time of callus formation. Of course, we know that in old people the callus formation does not take place so readily.

We must look after certain conditions of calcium deficiency in the blood content, as Dr. Walke has just mentioned. Then, too, frequent x-rays should not be neglected.

I am glad the mental attitude of the patient and the necessity for cooperation was stressed because, after all, that is the most important thing not only in the conditions we have been discussing but in every other condition, both medical and surgical.

Dr. Clarence B. Francisco (Kansas City, Mo.): I should like to suggest that Dr. Hart take the liberty of adding to Dr. Hilton's quotation, that in addition to physiological and mechanical rest, the instillation of confidence in the patient that he is going to improve and that when he gets well he will have a return of function. I think that is one of the important things for technicians doing physical therapy work to remember, particularly with adults. I don't believe we practitioners quite understand how important that is, until we have something happen to us. Then our imagination simply will not be controlled. You have all sorts of fanciful problems, complications in your own mind, and you need a good deal of assurance that these things are not going to happen. We forget, in seeing these conditions in our patients, that they too have this tendency to develop a complex, which it is most important to prevent. As has been stated here, it is a very difficult complication to an injury.

In regard to Dr. Estes' discussion of fractures, I would emphasize the point of not waiting, as our predecessors did until the swelling disappears. It is very difficult to get a sound principle operating generally. I very frequently hear now the excuse that they didn't attempt reduction on account of the swelling. They preferred to wait, and put the limb in pillow splints.

Then there is a point of prognosis. The last speaker mentioned what a disturbing afternoon some of the oldtimers would have had if they had heard these papers. They had a great loophole, they gave the most unfavorable prognosis for every fracture and every injury they saw, and that served them well. We will have to work pretty hard if we are going to get the best results in any sort of a fracture. One of the disappointing things in the treatment has been the hope that something would be developed whereby we could have a routine method of treating fractures and wouldn't have to pay special attention to them. I am sure we will never realize any such plan, as we have to deal with individual problems and must work hard and get the patient to contribute his share. If we do that, we can hope for a good deal.

About hallux valgus, I am reminded of an incident that occurred one time when I was in London. Over there the orthopedists work directly under the surgeons, as they do here in some places. Bristol's chief surgeon asked him what sort of results he got in bunion operations. Bristol replied, "Very good." His chief asked him, "What operation do you do?" He said he did what is known as the Mayo operation, the resection of the head of the first metatarsal bone. His chief expressed some interest in the matter, some concern about it, and some little apparent doubt about what the results were. Bristol replied, "Give me a week and I will show you 100 cases." I stayed over to see the 100 cases, and the results of those 100 cases were very satisfactory with that operation.

Dr. W. L. Estes, Jr. (closing): The idea of presenting this paper was to more or less express the surgeon's viewpoint in preventing disability following fractures, and to point out how there should be proper cooperation between the physical therapist and the surgeon in accomplishing the best results. If we keep that in mind we will be able to remember that we must also individualize. We have stated certain procedures that are necessary to avoid disability, but they must be applied individually.

There may be some instances when we need no physical therapy. In other instances physical therapy will be exceedingly valuable, but the point is if it is used it will be most valuable when it is used early. That was what I particularly wanted to bring out.

If we have proper cooperation between the entire staff of those who are undertaking the treatment of fractures, there should be no difficulty about the proper supervision to carry them through to as successful and as complete a recovery as they are entitled.

PARAFFIN OSMOSE COMPRESS (SCHUBERT) *

FRANZ NAGELSCHMIDT, M.D.

LONDON

The value of heat application to the skin has been widely appreciated. It is of advantage to have different modalities at one's disposal for that very purpose. Therefore, I present a method of applying paraffin which I have used for more than a year in hospital as well as private practice.

The usual application consists of either immersing part of the body into a vessel containing melted paraffin or in covering the body or parts of it with small quantities of paraffin poured over the patient and the part covered with sheets or blankets. With progressive cooling a skin of solidified paraffin forms around the body and due to the poor conductivity of the paraffin for heat, considerable heating effect is produced within the skin. This cuirass of solidified paraffin prevents the irradiation of heat from the skin and further heat application from outside. While the heat existing between the paraffin layer and the skin is carried away by the blood and lymph circulation, a cooling effect by evaporation of sweat is impossible with the usual application because paraffin is not permeable either to water or to steam.

Advantage of Compress

The advantage of the paraffin osmose compress lies in the fact that it contains an electric resistance heating wire system which keeps the paraffin layer liquefied and permits of a certain amount of evaporation and constant drainage of some of the produced sweat. Thus, a creamy moist substance is created between the paraffin layer and the skin, and some sweat leaks out underneath the compress towards the edges where it is soaked up by the wrapping material.

A further advantage lies in the fact that the degree of heating can be regulated by a three step switching device, which enables us to keep the temperature of the compress at a higher or lower level according to the requirements of the case or the comfort of the patient. There is technically no limit to the time of application, but the usual duration which I have found efficacious did not exceed two hours. Practically it would be possible to apply it as long as one wishes with the desired degree of temperature.

The application is made by applying a thin layer of solidified but flexible paraffin over the area to be treated. These "foils" are delivered in blocks of fifty or one hundred and may be used two or three times for the same person. The compress lasts for about one hundred to one hundred fifty treatments. A certain amount of paraffin is lost by leakage with each treatment but this can be refilled by the factory at a small charge. Lately, the paraffin foils which are placed between the compress and the body can be furnished with admixtures of iodine, sulphur and other medicaments permitting a combined effect. Experiments in regard to the probable absorption of ionized substances under the influence of the heat and of the possible magnetic field produced around the compress through the flowing current are not yet far enough advanced to permit a definite conclusion.

Indication

I have treated arthritis of different forms and joints, lumbago, sciatica, rheumatism and undefined painful ailments. Most of the cases were improved

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 11, 1935.

and the patients considered the treatment as agreeable. I have not encountered complications nor burns. It seems that the results depend to a great extent on the duration and number of applications. The cases which were not benefited had between three and nine applications, except one grave case of arthritis of the left knee of years standing, which was not improved after fourteen treatments. Improvements were usually observed after five treatments. Those that were completely relieved required thirty-four to fifty-four treatments. The usual duration of each treatment was one hour.

The compresses are available in different sizes, small ones for sinus treatments, medium and larger ones for greater areas. It takes generally fifteen to twenty minutes until the compress is thoroughly heated, soft and flexible. When it has reached this point it can be applied from one patient to the other without delay. Cleaning is possible in the usual way.

The effect besides producing perspiration is that of an intense hyperemia. The skin temperature may rise up to one hundred and twenty-four degrees during treatment and has again reached the usual temperature of ninety-three degrees in some cases only after more than four hours, if the patients are kept in bed. The hyperemia generally lasts one and one-half hours.

The indications are the usual ones for local heat applications. The chief advantage seems to be that the paraffin does not solidify; that the compress offers the possibility of applying a combination of creamy-fat and damp treatment with a temperature which can be regulated for any desired time. The treatment is cheap, comfortable and can be applied anywhere. No special preparation is required.

Discussion

Dr. Disraeli Kobak (Chicago): Paraffin therapy is far from new in modern practice and its appreciation is testified by the increasing literature on the subject. Unfortunately it does not enjoy the spectacular qualities of some of the other agencies in physical medicine and hence discussion on this topic is usually restricted to traumatic and arthritic complications. It is only when some modification or so-called innovation is presented that we are awakened to its potential therapeutic possibilities. Whatever else may be said about its value, one thing is certain: its therapeutic action is due to its thermal qualities. Any other virtue predicated for it is based on speculative knowledge. In the 1933 session of the Congress, Wyatt presented a paper on the value of paraffin in certain forms of arthritis, and in my discussion I pointed out the value and use of warm paraffin bandages in arthritis of the knees, shoulders and the like. The value of impregnated bandages with paraffin may be enhanced by external heating, but more proof must be presented of the value of medicinals in paraffin before it can be considered as a scientific procedure in physical therapy.

Dr. Franz Nagelschmidt (closing): It is a question of resorption of medicamentous materials, something which has not yet been worked out. I think the possibility of ionic transport might be present.

STATUS OF DIATHERMY IN PNEUMONIA *

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NEW HAVEN, CONN.

It is rather difficult to present an entirely new point of view on the employment of diathermy in pneumonia. This treatment in pneumonia has steadily and undramatically demonstrated its value during the past decade and a half. Fifty-five articles and thirteen medical texts devoting space to its technic attest to its effectiveness. Its early history need not here be reviewed except to point out that the first work was checked in every particular at the United States Marine Hospital No. 21, in New York. It is especially gratifying to the writer that every fact presented in his early texts and papers has been not only confirmed from year to year, but even clinicians in widely scattered sections have surpassed his own mortality figures in reasonably large groups of cases.

The correction of four early errors, all of them on the conservative side, explains the great improvement in technic and recent mortality rate. We formerly used too small electrodes, gave too few and too feeble treatments, and discontinued applications in empyema and extreme degrees of hypotension.

The writer's paper read before a section of the Royal Society of Medicine, London, in 1926 was reprinted in the *British Medical Journal*, and has led to the widespread use of diathermy in pneumonia in Britain and her Colonies. Some of the most interesting late reports are coming in from these sources. Among the most recent of these is from West Middlesex Hospital, London. Dr. Marjorie Warren reports a most interesting series of cases. For several winters their results were so favorable that the directors fitted up a special diathermy treatment ward for patients with pneumonia. Shortly after it was ready last winter it was used to capacity to serve patients from a Welsh labor group who had marched on London to petition Parliament.

These workers arrived in the vicinity of London in a pitiful physical state. Undernourished, ragged, sleeping on the ground, they contracted pneumonia in large numbers. Of these unfavorable cases over fifty were treated with a mortality of three per cent. (The average mortality in England is somewhat greater than ours — about 35 per cent.)

Dr. C. A. Robinson of the same hospital reporting on their cases as a whole gave a mortality of 12 per cent in a total of 170 cases. As these figures covered several different epidemics over considerable time, they present a fair picture of results. He stated that sleeplessness caused by toxemia was not relieved. His patients all liked the treatments, were all made more comfortable by it, and never refused it. It is now the established routine treatment for all pneumonia cases.

The following figures (table 1) are reported from the Employees' Hospital of the Tennessee Coal, Iron and Railroad Company, Fairfield, Alabama by Dr. Groesbeck F. Walsh:

TABLE 1. — *Report of Pneumonia Cases Treated with Diathermy at the Employees' Hospital of the Tennessee Coal, Iron and Railroad Company.*

	Recovered	Died	Mortality
Treated Cases 95	83	12	12.4 per cent
Control Cases 59	47	12	20.3 per cent

* Read before the New York Physical Therapy Society, New York, November 6, 1935.

In every case x-rays were obtained. Conventionally treated, 400 previous cases gave a mortality of 25 per cent. Symptomatic relief was obtained in all of the treated cases, and no untoward effects followed the use of diathermy.

TABLE 2.—*Report of Pneumonia Cases Treated with Diathermy at the United States Marine Hospital, No. 21, New York.*

Type	No.	Recovered	Died	Mortality Per Cent
I	4	4	0	0
II	2	2	0	0
III	3	2	1	33
IV	13	10	3	23
Streptococcic	3	1	2	66
Undetermined	11	10	1	9
	36	29	7	19.4
Controls				
I	0	0	0	0
II	3	0	3	100
III	0	0	0	0
IV	7	6	1	14.3
Streptococcic	2	1	1	50
Undetermined	9	5	4	44.4
	21	12	9	42.9

The United States Veteran Hospital, Newington, Conn., reports seventeen cases without a death in the season of 1934-1935. Two of these were apparently hopeless postoperative cases, and the remaining were about evenly divided as to type.

The experiences reported by St. Mary's Hospital, Hoboken, New Jersey are shown (table 3):

TABLE 3.—*Report of Pneumonia Cases Treated with Diathermy at St. Mary's Hospital, Hoboken, N. J.*

Type	No.	Recovered	Died	Mortality Per Cent
I	3	3	0	0
II	1	1	0	0
III	3	3	0	0
IV	9	7	2	28
Streptococcic	1	0	1	100
Undetermined	37	36	1	3
	54	50	4	8.

Commander C. S. Stephenson, Medical Corps, United States Navy had in the United States Marine Hospital, Brooklyn, 114 patients of undetermined type with a mortality of 8.4 per cent.

Dr. U. V. Portmann of the Cleveland Clinic published in a report under the caption "Observations on the Use of Diathermy for the Prevention and Treatment of Surgical Shock" in the *Archives of Physical Therapy, X-Ray and Radium*, (September, 1928):

> We have also attempted to treat and prevent severe postoperative pulmonary complications. Fortunately, we see but few cases of lobar pneumonia in our hospital, but we have been gratified with the results obtained in those cases which have been treated with diathermy at a sufficiently early stage of the disease. It is now our aim to prevent the development of pneumonia by the immediate application of diathermy to the chest of any patient in whom an unexplained rise in temperature with increased respiratory rate and pulse rate occurs, whether or not the complete clinical picture of pneumonia is presented. Doubtless we are thus treating some cases of simple bronchitis, or of pulmonary collapse, but even in such cases improvement is usually observed within twenty-four to forty-eight hours, an observation which makes us believe that this attempt to prevent or abort serious pulmonary diseases is very much worth while.

No single scientific investigation of diathermy as applied to the lungs has caused more interest than that done in the Rockefeller Institute by Binger and Christie, published under the heading "An Experimental Study of Diathermy," in the *Journal of Experimental Medicine*, October 1st and November 1st, 1927.

There has been a great deal of misconception and misinterpretation of the findings of these two investigators. Inasmuch as the writer was invited to assist in this study, he feels that he is in a position to know more than a cursory reading of the articles would afford. Let us review a few of the essential findings.

Article 1.—"The Measurement of Lung Temperature." On page 575 we read: "In anesthetized animals (dogs) we have frequently seen a rise in rectal temperature of as much as 5 to 6 degrees C." On page 580 we read: "In *normal* lung the temperature was 0.39 degree C. below rectal. After diathermy it was 0.4 degree C. above rectal, a rise of only about 0.8 degree C." This point has been widely quoted, entirely ignoring the fact that the *actual lung temperature* rose from 36.45, 36.43, and 36.42 degrees C to 41.43, 41.35, and 41.43 degrees C., an actual rise of about 5 degrees C. in normal, aerated lung. In consolidated lung they found it to be still higher (p. 582).

Article 2 is headed "Conditions Necessary for the Production of Local Heat in the Lungs." On page 507 is stated: "After a few minutes of diathermy through both lungs the temperature reading was: right lung 38.63 degrees C.; left lung 38.73 degrees C. Eleven minutes after shutting off the blood supply to the left lung, (occluding left pulmonary artery) the reading was: right lung 38.85 degrees C.; left lung 40.80 degrees C. In other words the temperature in that short time rose 0.2 degree C. in the aerated lung, and 2.0 degrees C. in the occluded lung."

The authors concluded: "Interruption of the circulation . . . . does, however, result in a sudden rise of temperature in the lung. A very sharp and drastic rise took place after the animal was killed."

Article 4 is captioned: "Evidence for the Penetration of High Frequency Currents Through the Living Body." In this Binger and Christie take up a leading issue by Bettman and Crohn (*J. A. M. A.* **88**:532, 1927) in which the latter attempted by crude experiments based on thermometer readings, to prove the fallacy of deep tissue heating by diathermy. Binger and Christie refuted their conclusion by using thermocouples. They proved that there was no "skin effect" in living tissue, but that the current tended to travel directly through the tissues, from electrode to electrode. They proved further that the heat was not driven in by conduction (p. 722) that lung heating can occur even when the thoracic wall is simultaneously cooled and that "deep heating during diathermy is greater than that which results from the application of local heat to the skin." "The lungs can be heated by diathermy in spite of simultaneous cooling of the chest wall" (p. 731).

Formerly in the discussions following the writer's paper on this subject, small groups of ten, twenty or forty cases were reported from the floor. Lately these groups run into the hundreds. Nearly every Government hospital of the Army, Navy, United States Public Health Service, Veterans' Administration, and Old Soldiers' Home, is using this measure as an adjunct in the treatment of pneumonia.

Symptomatic relief is striking enough to justify its routine use. This has been attested to by every writer on the subject. With one or two exceptions, there is a remarkable uniformity in the mortality figures, averaging about 12 per cent. This represents reports on many hundreds of cases, many different epidemics in which different types predominated throughout fifteen years. Our own series comprises 939 cases with a mortality of 12 per cent. Many of the cases were in homes of the poor with no opportunity for typing. They were, on the whole, of more than average severity. Only four deaths occurred in cases

treated within the first forty-eight hours. One group of 23 hemolytic streptococcus pneumonia occurring in a New England preparatory school was typed in a nearby hospital and carried through without a single loss.

The present technic consists of applying large electrodes, 1800 to 2800 ma. for 30 to 40 minutes, every three hours, in severe cases. This treatment may be intensified where needed.

Relief of pain, deeper respiration, improved color, slower and steadier pulse, greater ease of expectoration and a tendency to sleep, are noted in the literature. One unusual result is of particular significance — the fall of temperature by lysis. While it is true that we do not see as many drops by crisis as formerly, it still remains the characteristic type of temperature fall in this disease. Any agent which is able to change the crisis is about 65 per cent and into lysis in 97 per cent must be accepted as definitely affecting the clinical course of pneumonia. This factor is of the utmost importance. Pneumonia deaths are largely from cardiac failure. Each degree of temperature lessened reduces the heart rate about six beats. This means more rest to the toxic and over-worked myocardium. Moreover, the gradual lowering of temperature means a saving of all of the energy consumed in maintaining maximum temperature to the final day of the disease.

There is reason to welcome every advance in the use of serum. This as well as any other approved treatment need not be put aside for the use of diathermy.

Conclusion

1. During fifteen years of use, diathermy has proven of steadily increasing value as an adjunct in the treatment of pneumonia.

2. Symptomatic relief, justifying its routine use is attested to by every writer on the subject.

3. Mortality is reduced at an average of about 70 per cent.

4. Cases treated early will show a much greater drop in the mortality rate.

262 Bradley Street.

Discussion

Dr. J. G. M. Bullowa (New York): Physical therapists should concern themselves in pneumonia with atmosphere control and oxygen therapy, which is actually in their field. This had hitherto been neglected by them to the disadvantage of both patient and physician. In respect to diathermy there is no adequate study or proper control of the cases reported in the literature, but much wishful thinking and slipshod observation. Unless the cases are divided into those which were blood invaded and those which were not blood invaded, and separated in respect to age and character of the invading mechanism, proper inferences in respect to benefits cannot be drawn. To secure just evaluations, alternate cases would have to be taken as controls, and not the heterogeneous group of cases which constitute the pneumonia of any single period. The work of Binger was freely quoted, in which it was stated that there had been no rise in temperature in human lungs of patients subjected to diathermy, and that the rise of temperature mentioned by the reader of the paper had occurred in dogs under anesthesia, in whom the heat mechanism center had been in abeyance. The possible dangers of oxygen therapy in the presence of oxygen enriched air were stressed. The clothing might burn readily with a slight spark from apparatus or electrodes. Patients in whom the administration of oxygen could be interrupted for a sufficient period of time to permit prolonged diathermy probably did not require oxygen therapy, and accordingly were not severely ill. The chief benefits of diathermy were probably due to suggestion, and this might have an influence on the ultimate outcome unless sufficient cases of each type were studied and the usual clinical picture in respect to duration altered. The improvement noted might be fortuitous. The great life-saving value of diathermy has not, in my opinion, been demonstrated or established, and it would indeed be unfortunate if physicians in the community were to delay the administration of specific serums pending a trial of diathermy.

I offer Dr. Titus an opportunity to demonstrate the value of diathermy on carefully controlled cases at Harlem Hospital, if he will provide the needed equipment and technical assistance.

Dr. N. E. Titus (New York): All who have seen the effectiveness of diathermy in conjunction with accepted treatments of pneumonia will regret the unfortunate publication of Binger and Christie that emanated from the Rockefeller Institute in 1927, and has been generally accepted by the medical profession as the last word. In all electrical treatments technic is most important and also the apparatus used must be suitable to produce the desired reaction. Binger and Christie neglected both of these important factors and since they did not obtain results and their conclusions had the stamp of authority, diathermy as a rational aid in the treatment of pneumonia has suffered untold harm. Even at the Presbyterian Hospital in New York, when I requested permission to demonstrate the usefulness of diathermy, I was turned down by the medical staff on the ground that since Binger and Christie proved that diathermy could not heat up the lung, they did not think this treatment was rational. This treatment with diathermy has been an orphan that has been left on the doorstep of every big teaching and research hospital. Not one of these places has been broad-minded enough to even give it a trial and the serious efforts of those who have worked on well controlled cases are decried without a hearing.

We make no claim that diathermy is a cure for pneumonia, nor that it is more important than any other method of treatment, but since its effects are never contraindicated and can not possibly do any harm, unless there is present a lung abscess, it remains a source of wonderment to us that colleagues will not even permit its use and will deny us the right to improve their mortality statistics.

I wish to thank Dr. Bullowa for his invitation tonight to work on cases of pneumonia this winter with him. He is the first man with such interest in pneumonia who has ever said he is willing to give diathermy a trial. Just as soon as I can raise the finances for the necessary technical help, I shall be ready and willing to go ahead and accept his kind invitation.

Dr. W. P. Anderton (New York): Dr. Stewart's paper has interested me very much, because I have followed the subject since purchasing his book in 1923. He has considered the subject most carefully, and Dr. Bullowa's discussion, with vivid demonstration of the importance of bacteriemia, has added much food for thought.

The evaluation of any therapeutic procedure is always a difficult problem. When one peruses the recent literature, one finds that many methods of attacking pneumonia are advocated: Artificial pneumothorax, convalescent serum, intravenous injection of glucose, vaccine, specific serums, manual friction and vibration of the thorax, quinine and its derivatives metrazal-quinine and quinine-calcium, parenteral liver in streptococcus pneumonia, phototherapy, and scientific neglect.

In spite of the arguments in favor of diathermy, I am not entirely convinced of its usefulness in pneumonia. The method of estimating treatment in this disease, as developed at Bellevue Hospital in the study of antipneumococcus serum and digitalis, would seem to me a wise procedure to try with diathermy. This would require a large hospital service where each two cases of the same type of pneumococcus pneumonia would be treated similarly with the exception that one of each pair would receive diahermy, and the other would not. Such an approach to the problem ought to give us valuable evidence.

TRACHOMA TREATED BY ZINC IONIZATION *

(Preliminary Report)

SAMUEL M. EDISON, M.D.
CHICAGO

Inasmuch as this report deals with a comparatively new form of treatment of trachoma, it is proper to review the methods which are now being employed in different parts of the world. Our modern therapy is essentially similar to that practiced by the ancients. In the *pseudo*-Hippocratic manuscript, about 460 B.C., inflammation of the lids with thickening and granulations followed by corneal ulcers and opacities is described. It recognizes the disease as chronic and the treatment both medical and surgical is recorded. Acetate of copper, ashes of copper, expression and rubbing of the lids are recommended, it being stated further "When thou rubbest the eyelids for this malady, rub them well with clean thick wool wound around a wooden stick." For ptosis, a red hot iron was used after making punctures, taking care not to touch the lid-margins.

* Read before the Chicago Ophthalmological Society, December 16, 1935.

Current Therapeutic Methods

At the present time in Great Britain, other European countries, Egypt and India, the treatment of trachoma consists as follows:

In the stage of granulations, one of three methods is used.[1]

(1) Under local anaesthesia the granulations are expressed with forceps, followed by the repeated painting of the affected conjunctiva with 2 per cent silver nitrate solution and frequent irrigation with boric acid solution.

(2) Scarification of the conjunctiva and, later, rubbing and massaging, repeated at regular intervals. Applications of 1 to 500 bichloride of mercury, and the frequent use of 1 to 7000 bichloride or 1 to 5000 oxycyanide of mercury solutions.

3. Cauterization of special areas with the Paquelin or galvano-cautery, especially the conjunctiva at the upper border of the tarsus when this is the seat of prolific granulations. These methods are used singly or combined.

In the regressive stage, the copper sulphate stick is applied to the conjunctiva once or twice weekly, and zinc sulphate solution (1 or 2 per cent) is used three times daily, or, a 4 per cent ointment of citrate of copper, once daily, with repeated irrigations of boric acid solutions.

Fuchs[2] maintains that copper sulphate as a rule is contraindicated in the presence of progressive corneal processes (ulcers and pannus), and silver is inadequate when marked hypertrophy of the conjunctiva is present. Also, the prolonged use of silver may lead to argyrosis. Lindner and others believe that the copper sulphate stick is of great value even in the presence of corneal ulcer; and with the exception of a mercurial wash for home use, or a copper ointment, jequirity, and oil of chaulmoogra, these comprise the treatment as used in Germany, Austria and Hungary and in the Mediterranean countries.

In France, Delanoe,[3] in 1926, originated a method of vigorously rubbing the conjunctiva of the lids and the cul-de-sac with a glass rod tightly wrapped with cotton immersed in oil of chaulmoogra.

Kuznetskaya,[4] of the Perm Eye Clinic in Russia, treated trachoma in all of its stages according to the technic of Delanoe. He concluded that it offers no particular advantage over other procedures, and that a course with it is long drawn out and subject to relapses. The oil therapy is painless, however, causing only slight irritation and resulting in rapid disappearance of photophobia, blepharospasm, catarrhal secretion, and reduction of pannus. It is believed that the effects are due to the efficacy of the massage and the bactericidal properties of the oil.

The copper-chaulmoograte stick does not give as lasting results as the oil and is more irritating. The eye tolerates better the ointment of chaulmoogra-copper salts, although the former aids in resolution of pannus.

Recently Selinger added quinine bisulphate to the remedies for trachoma. This preparation is quite efficacious in certain cases and is being used in many clinics, but reports are not yet available for final analysis and conclusions.

Our present method of application of medical agents to the conjunctiva in trachoma is inadequate because none of them, even the copper sulphate stick, ever penetrates beyond the epithelial layers and the superficial subepithelial beds. Little if any medication ever reaches the subepithelial tissues where the disease is located. Even massaging and rubbing of medicaments into the lids result in very little diffusion of copper, mercury, zinc, or silver, deep enough to affect the subepithelial tissues, as is shown by histologic slides of conjunctival tissue after such treatments.

Surgical procedures including expression, rubbing, scraping, and cauterization cause considerable mutilation of the tissues of the lids, and furthermore such treatments are hardly ever complete enough.

Ionization In Trachoma

The inadequacy of present methods prompted me to utilize the galvanic current for diffusion of zinc or other metals into the subepithelial tissues in order to reach the foci of the disease. The procedure which is known as ionization accomplishes this but is accompanied by moderate tissue-reactions, considerable deep cellular infiltration with lymphocytes, and especially with polymorphonuclear leucocytes. The disease is attacked in the follicles and in the infiltrations. The effect of ionization is more intensive than that caused by copper sulphate, mercury, and other metals, or by jequirity and chaulmoogra oil.

Ombini,[5] in 1877, was probably the first to report the use of electrolysis in trachoma. He applied a platinum electrode directly to the granules using one and a half to two ma., which caused coagulation. Leduc[6] states that the electric current in living tissues as in all electrolytes is nothing else than the double current of the ions. The effects of the currents are only effects of the ions.

Tissues are profoundly modified by the introduction of different ions. Impermeable cells can be diffused and even saturated with ions into depths with a variety of chemicophysiological actions. Tissues may be impregnated with ions and functional as well as histologic changes noted. Edema, echymosis, sloughing, followed by induration and cicatrization in a definite manner can be observed.

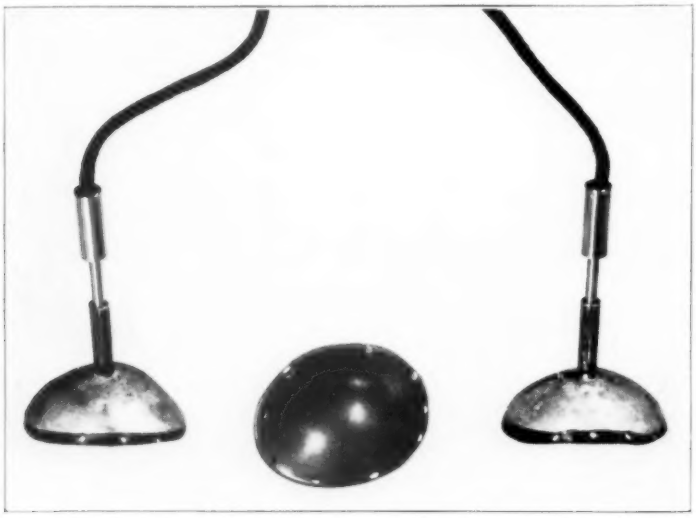


Fig. 1. — Elliptical concave shaped electrodes, seen from both lateral and internal positions.

One of the greatest difficulties in the experimental work was to obtain a suitable electrode which would protect the cornea first of all and then provide a sufficiently large metallic surface to distribute the current evenly. In addition the electrode would have to be covered with a suitable material to hold the electrolytic solution. After many trials with different models, I finally succeeded in devising an electrode which answers all these requirements. It is made of a shell of zinc to conform with the shape of the globe, completely insulated on the corneal or posterior surface. On the anterior surface, which is applied to the conjunctiva of the tarsi and fornices, there is fastened chamois skin or a gauze pad moistened with the electrolytic solution. In the center is riveted a post for connection with the current.

Method of Application

Butyn anesthesia is used. With the patient in the recumbent position the negative pole is connected to a pad (saturated with normal salt solution) affixed to the patient's arm or back. The positive pole is connected to the eye electrode, previously saturated with a 2 per cent zinc sulphate solution, and inserted under the lids. A current of about 5 to 7 ma. from a galvanic apparatus, capable of delivering at least 10 ma., is turned on gradually for ten minutes. After removal of the electrode the fornices are thoroughly irrigated with saline solution, as the zinc chloride solution mixed with the lachrymal fluid is quite irritating. On inspection of the conjunctiva one sees a grayish yellow film which is firmly attached wherever the electrode was in contact. The film remains for about three to four days deeply imbedded in the conjunctival subepithelial tissues. Care must be taken that the insulation is intact on the posterior or corneal surface of the electrode as well as on its margins. Exposure of the metallic zinc causes cauterization and sloughing.

I found no reference in the American literature to this form of treatment of trachoma, and only one author, V. Ruata,[7] of Padua, Italy, reported treating trachoma in all forms with ionization to the lids. The electrolyte consisted of copper sulphate, 1:100; picric acid 1:100; thiosinamine 2:100, all combined in solution. Ruata employed positive galvanism (10 ma.) to the conjunctiva for from ten minutes to a half hour. No mention is made of the electrodes nor is the technic described in detail.

Case Reports

In my series 53 cases of trachoma were treated. The patients were from the Illinois Charitable Eye and Ear Infirmary, from the Trachoma State Clinic of Illinois, and from the Mandel Clinic of the Michael Reese Hospital. Forty-four cases received four treatments, at weekly intervals. Nine cases received only one or two treatments. Where there was binocular involvement, one eye was treated, usually selecting the more active one, and using the other eye as control or for comparison with other treatments. The cases represented all stages of the disease with various types of complications.

Thirty-one cases in all were discharged, with complete arrest of the disease, nine with amelioration of all symptoms, and four with no improvement. Five cases of the series were of the acute inflammatory type with no previous history of eye trouble. They were definite contacts, and when they reported for treatment gave a history of having had the condition from two to five weeks. Two were of the papillary variety in which the tarsal conjunctiva was hypertrophied and humpy and mulberry-like in appearance. Three had definite trachoma follicles in the entire transitional folds and on the tarsal conjunctiva.

Four cases were of the succulent type of Stellwag, in which the conjunctiva was smooth, thick, yellow, succulent, and translucent. Common symptoms were photophobia, lachrymation, disturbance of vision, and slight discharge. All of the patients presented lid infiltrations.

Fourteen cases were of the so-called chronic, cicatricial recurrent type, with marked hypertrophy of the lids, ptosis, and granular formation. There were previous histories of repeated ulcers, corneal scars and pannus in varying degrees. Eight cases of this variety had also marked thickening of the lids and deformity from previous attacks. They reported for treatment on account of new flareups, and in three patients ulcers were observed.

Seven patients had given a history of chronic complicated trachoma and presented themselves with marked loss of vision in one or both eyes due to scars and pannus and with recent recrudescences.

The remainder of the series was of the type in which the symptoms and

progress of the disease were never arrested completely with or without treatment. They had been treated for trachoma from two to thirty-two years without any apparent improvement and with gradual loss of vision from pannus and corneal scars. They were reconciled to their fate. Some had abandoned their occupations as hopeless incurables and came for treatment only when subjective symptoms arose.

Of the fifty-three patients nine refused zinc ionization after the first or second treatment. Forty-four were treated four times, one treatment each at weekly intervals. Of the first nine mentioned, two experienced some relief in subjective symptoms and a measure of improvement objectively.

Of the forty-four patients who received four treatments each, thirty-one were definitely cleared up. Follicles completely disappeared and the pannus receded in some to a marked degree. They had no subjective symptoms whatever, and in nine cases vision improved from 0.1 to 0.3. The mucous membrane was smooth with considerable thinning of the lids. The improvement in the structural changes of the conjunctiva and the papillary hypertrophy was noteworthy in all patients. The resulting cicatrization appeared scanty and smooth.

Reactions From Treatment

Forty-seven patients had moderate reactions consisting of engorgement of vessels, edema of the conjunctiva and lids, and all the way from mild irritation to considerable amount of pain, which usually was relieved by cold compresses. These reactions subsided in from forty-eight to ninety-six hours.

Six patients had severe reactions with a great deal of edema and discharge, and in two, there was desquamation of the conjunctival epithelium with profuse discharge which took about ten days to clear up. No other complications were noted in the entire series excepting one patient at the infirmary, a white female, age 32, who had been suffering from trachoma for three years and in whom an iritis developed after the third treatment. Dr. Woods and I believed that the treatment had little to do with the development of the iritis. The history showed that there had been an attack of iritis two years before.

Summary and Conclusions

1. In all clinical stages of trachoma zinc ionization produced complete arrest in thirty-one cases, about 70.5 per cent of those who received four treatments, one each at weekly intervals.

2. Amelioration of all subjective symptoms, with notable beginning regression of the follicles and cicatrization, was obtained in nine cases, about 20.5 per cent. Four patients (9 per cent) did not respond to the treatment.

3. In seven patients of the series, no recrudescence occurred after eighteen months of apparent cure.

4. Zinc ionization was employed in the acute or chronic stages and in the presence of corneal ulcer or pannus.

5. The course of the disease was shortened in all cases. None of the thirty-one patients discharged required further active treatment after the tenth week.

6. Since the electrodes are in contact with the entire conjunctiva, including the fornices, lids, inner and outer canthi and the caruncle, throughout the treatment, the entire pathologic area is reached during each ionization.

7. No complications or sequellae resulted from the treatments in any of the cases.

185 North Wabash Avenue.

(*Concluded on page 116*)

COMBINATION ELECTRIC SUTURING NEEDLE AND ELECTROTOME

GUSTAVUS M. BLECH, M.D.

CHICAGO

This instrument has been devised to meet the criticism that suturing of wounds resulting from electrosurgical excision of malignant neoplasms may defeat the very purpose of the utilization of the high frequency current. It has been maintained that the introduction of cold surgical needles into and through the wound margins may force malignant cells that had been overlooked during operation into the circulation and thus produce metastases. As there is theoretically some justification for the criticism, it is advantageous to begin and complete all operations for malignant neoplasms electrosurgically, including the closure of the wound.

The instrument shown in the illustration is constructed on the principle of the Reverdin needle. It is secured in an insulating handle the interior of which (not shown in the illustration) contains a sliding device by which the

Fig. 1. — Combination needle electrotome.

needle electrototome can be shifted to any desired length without breaking contact with the current.

The technic is simple. The needle is pushed through both wound lips with the aid of the cutting or coagulating current. When the hole at the point is exposed to reach, the current is shut off, the needle is threaded with a strand of any desired suturing material, withdrawn while the current is off and the suture tied in the usual manner.

Coagulation of the stitch canal takes place within limits, the canal closing even before the stitches are removed, which for electrosurgical wounds normally is carried out on the tenth postoperative day. Needless to emphasize, the sharp point facilitates concentration of any high frequency current and with the instrument held at an angle of about 45 degrees so that the curved part is vertical to the skin, serves well as an electrotome. The little appliance is made for me by the McIntosh Electric Corporation of Chicago, and is not patented.

108 No. State Street.

FEVER THERAPY APPARATUS *

RODNEY F. ATSATT, M.D., F.A.C.S.

and

LUELLA E. PATTERSON

SANTA BARBARA, CALIF.

A highly satisfactory, inexpensive device for the production of artificial fever by means of conditioned air is herein described together with the working plans for the construction of such a device. It has been in use nearly two years at the Santa Barbara Cottage Hospital, and fulfills the essential requirements of safety and simplicity.

The apparatus consists of two cabinets constructed of celotex panels. The upper one is suspended from the ceiling by ropes and pulleys — the lower one rests on the floor.

The lower cabinet. — This portion of the device is for the massive production of hot moist air subject to gross manual control. It consists of a box measuring 80 inches in length, 31 inches in height and 33 inches in width with solid

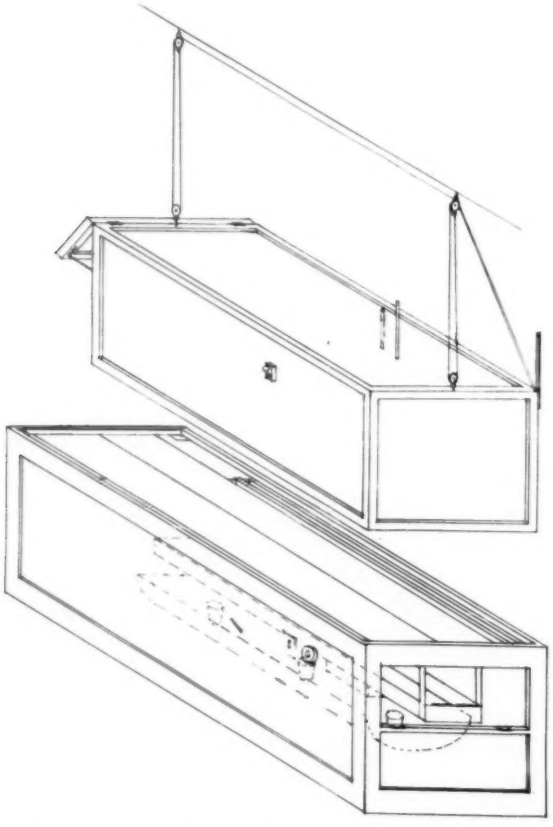


Fig. 1. — Projected view of apparatus for fever therapy.

* From the Santa Barbara Clinic.

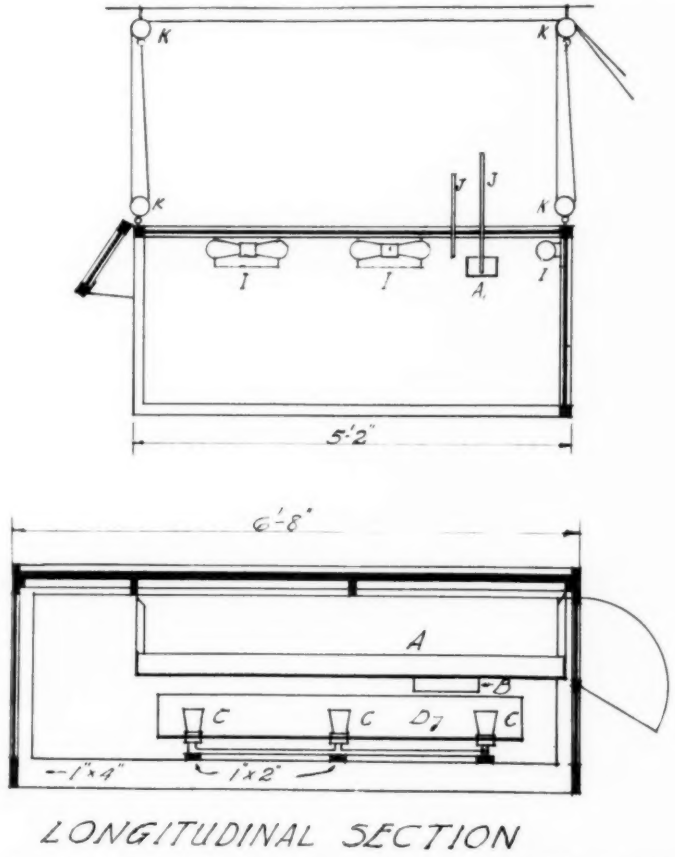
panels for sides and one end — the lower end has a door for convenience in adjusting the heating elements and also for ventilation if and when desired. The top of the box, upon which the patient lies, consists of a solid center panel 22 inches wide, margined on either side by a 4 inch grating which allows the entrance of the hot moist air into the upper cabinet. The head end of the grating is blocked down 18 inches to avoid the escape of heat about the pillows.

The heat is generated by three 660 watt coil generators obtained at any electrical supply house. It is directed upward by means of a long curved tin reflector. The generators and switch are so wired that one, two or three elements can be in use at one time.

The moisture is supplied by a full length copper trough 3x10 inches, suspended 5 inches above the tops of the heating elements. Fastened to this trough is an ordinary flat coil heater, so that between the rising heat from the coils and the directly applied heat from the flat heater the water in the trough simmers and emanates moisture into the heated and rising air. The hot moist air enters the upper chamber through the side gratings. The flat coil heater is controlled by a switch on the side of the cabinet.

The upper cabinet. — This portion of the device is designed not only to confine the hot moist air which is generated in the box below but has an independent delicate heating system to permit automatic temperature control.

The cabinet, fitting just within a ridge on the upper edge of the lower cabinet also is constructed of celotex panels, and measures 32 inches in width, 26



LONGITUDINAL SECTION

Fig. 2. — A view of the longitudinal section of same apparatus, the parts being interpreted as follows: *A.* — Water pan; *A1.* — Wet bulb thermometer; *B.* — Heating element for water pan; *C.* — Heating elements; *D.* — Bright tin reflector; *I.* — Sixty watt carbon filament incandescent bulbs; *J.* — Thermometer; *K.* — Pulleys used in raising and lowering the top.

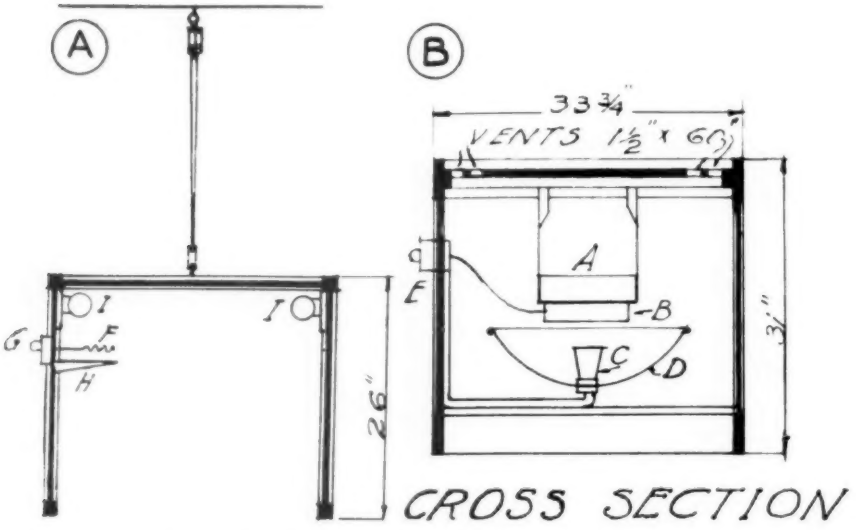


Fig. 3. — Cross section view of same apparatus. (A) Upper; (B). — Lower; *E.* — Switches; *F.* Thermoregulator; *G.* — Thermoregulator control; *H.* — Guard for thermoregulator.

inches in height and 62 inches in length. It is partly open at the head end, which is closed in use. by a rubber sheeting drop. This construction is so arranged that it is possible to take axillary temperature without disturbing the patient. The whole upper cabinet is insulated by a blanket cover.

This cabinet is heated by ten sixty watt carbon filament bulbs so connected with a de Kotinsky double pole thermoregulator that the turn of a knob will change the box temperature a fraction of a degree. The thermoregulator thus controls the temperature at any desired level.

The box temperature is observed by an ordinary thermometer of proper range. The usual air temperature in the cabinet varies from 120 to 130 degrees F. A second thermometer arranged as a wet bulb device gives an approximate idea of the humidity, though such calculations are grossly inaccurate because of the absence of a definite velocity of air past the wet bulb.

Ropes and pulleys suspend the upper cabinet from the ceiling. This suspension not only allows easy ingress to and exit from the fever therapy apparatus but is useful in emergencies for lifting the upper cabinet to cool the patient.

Discussion. — The above described device can be constructed by any competent hospital engineer at a cost considerably under one hundred dollars. This investment plus the purchase of an electric thermometer represents the major cost for a fever therapy department, but, as mentioned repeatedly by the authors[1,2,3] the fundamental need in this kind of work is for adequate medical supervision with the aid of a careful technician, well trained in both nursing and physical therapy. Fever therapy should always be a hospital procedure.

1421 State Street.

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3. ———: Development of Fever Therapy in the Santa Barbara Cottage Hospital, Arch. Phys. Therap., X-Ray, Rad. **16**:488 (Aug.) 1935.

. . . . Attend the Spring Session

SOUTHERN SECTION

American Congress of Physical Therapy

Auditorium, Medical School — Tulane University of Louisiana

MARCH 23, 24, 1936 - - - NEW ORLEANS

Evening Session, March 23, Jointly With Orleans Parich Medical Society

Physical Therapy in Lower Back Injuries.
FRANK H. WALKE, M.D., Staff, Schumpert Memorial Hospital; Highland Sanitarium, Shreveport, La.

Antirachitic Properties of Irradiated Evaporated Milk.
ROBERT A. STRONG, M.D., Professor of Pediatrics, Tulane University School of Medicine, New Orleans.

Radiathermy in Eye, Nose and Throat Conditions.
HENRY L. HILGARTNER, Jr., M.D., Texas School for Blind, Austin, Texas.

Newer Aspects of Ionization Therapy in Perennial Nasal Allergic Disorders.
A. R. HOLLENDER, M.D., Associate in Laryngology, Rhinology and Otology, University of Illinois College of Medicine, Chicago.

Present Status and Technique of Fever Therapy.
UPTON W. GILES, M.D., Professor of Physical Therapy, Louisiana State University, New Orleans.

The Physiology of Hyperpyrexia.
ROY H. TURNER, M.D., Assistant Professor of Experimental Medicine, Tulane University of Louisiana, New Orleans.

Fever Therapy in Gonorrheal Arthritis and Epididymitis.
J. A. TRAUTMAN, M.D., Passed Assistant-Surgeon, United States Public Health Service, United States Marine Hospital, New Orleans.

Hyperpyrexia in Bronchial Asthma.
KENNETH PHILLIPS, M.D., Miami, Florida.

Physical Measures in Traumatic Neurosis, Hysteria and Functional Nerve Conditions.
NATHAN H. POLMER, M.D., Assistant Professor of Clinical Medicine, Graduate School of Medicine, Tulane University of Louisiana, New Orleans.

Physical Therapy in Relation to Arthritis.
JOHN S. COULTER, M.D., Associate Professor of Physical Therapy, Northwestern University Medical School; Member, Council on Physical Therapy, American Medical Association, Chicago.

Effect of Carbon Arc Radiation on Blood Pressure and Cardiac Output.
HENRY LAURENS, Ph.D., Professor of Physiology, Tulane University School of Medicine, New Orleans.

The Generation of High Frequency Currents, Discussion of Concepts, Units and Radio Circuits as Applied to Short Wave Diathermy.
HOWARD A. CARTER, B.S., in M.E., Secretary, Council on Physical Therapy, American Medical Association, Chicago.

TUESDAY, MARCH 24

CLINICS

9 to 12 A.M. Department Physical Therapy, Touro Infirmary.
NATHAN H. POLMER, M.D., Assistant Professor of Clinical Medicine, Graduate School of Medicine, Tulane University of Louisiana, New Orleans.

1 to 4 P.M. Department of Physical Therapy, Louisiana State University with the cooperation of Gynecological and Dermatological Staffs.
UPTON W. GILES, M.D., Professor of Physical Therapy, Louisiana State University, New Orleans.

No Registration Fee — Physicians, Their Technicians and Medical Students Cordially Welcome

Write for program now to

N. H. Polmer, M.D., Chairman,
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American Congress of Physical Therapy,
Executive Offices,
30 N. Michigan Ave.,
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ATTEND THE SPRING SESSION

Mid-Western Section

AMERICAN CONGRESS OF PHYSICAL THERAPY

MARCH 4, 5, 1936

Plummer Hall, Mayo Clinic — **Rochester, Minn.**

Morning Session

WEDNESDAY, MARCH 4, 9 A. M.
Plummer Hall
FRANK H. KRUSEN, M.D., Presiding

1. **Address of Welcome — Charles W. Mayo, M.D.**
2. **The Use of Physical Agents in the Treatment of Circulatory Diseases**
N. W. BARKER, M.D., Section in Division of Medicine, The Mayo Clinic, Rochester, Minnesota.
Discussion: Simon H. Benson, Ph.D., Chicago; J. C. Elsom, M.D., Madison, Wisconsin.
3. **Studies in Tissue Heating with Short Wave Diathermy**
JOHN S. COULTER, M.D., Associate Professor of Physical Therapy, Northwestern University Medical School; Member, Council on Physical Therapy, American Medical Association, and
HOWARD A. CARTER, B.S., in M.E., Secretary, Council on Physical Therapy, American Medical Association, Chicago.
4. **Temperature Changes Produced in Various Tissues of Animals by High Frequency Electrical Fields**
CHARLES SHEARD, Ph.D., Division of Physics and Biophysical Research, The Mayo Foundation, Rochester, Minnesota.
Discussion of papers Nos. 3 and 4: Allan Hemingway, Ph.D., Minneapolis; A. U. Desjardins, M.D., Rochester, Minnesota.
5. **The Scope of Physical Therapy in Dermatology**
CLEVELAND WHITE, M.D., Assistant Professor of Dermatology, Northwestern University Medical School, Chicago.
Discussion: L. A. Brunsting, M.D., Rochester, Minnesota.
6. **Fever Therapy**
A. U. DESJARDINS, M.D., Section on Therapeutic Radiology, The Mayo Clinic, Rochester, Minnesota.
Discussion: William Bierman, M.D., New York; Clarence A. Neymann, M.D., Chicago.

Luncheon

KAHLER HOTEL

Tendered by the Mayo Clinic to all members and guests attending session.

Afternoon Session

WEDNESDAY, MARCH 4, 2 P. M.
Plummer Hall
JOHN S. COULTER, M.D., Presiding

7. **Newer Aspects of Ionization Therapy in Perennial Nasal Allergic Disorders**
A. R. HOLLENDER, M.D., Associate in Laryngology, Rhinology and Otology, University of Illinois College of Medicine, Chicago.
Discussion: Carl M. Anderson, M.D., Rochester, Minnesota; Frederick L. Wahrer, M.D., Marshalltown, Iowa.
8. **Physical Therapy in Relation to Orthopedics**
M. S. HENDERSON, M.D., Section on Orthopedic Surgery, The Mayo Clinic, Rochester, Minnesota.
Discussion: Robert Emmett Burns, M.D., Madison, Wisconsin; Edward T. Evans, M.D., Minneapolis, Minnesota.
9. **Influence of Short Wave Diathermy on the Blood**
DISRAELI KOBAK, M.D., Assistant Clinical Professor of Medicine (Physical Therapy), Rush Medical College of the University of Chicago, Chicago.
Discussion: W. E. Knapp, M.D., Minneapolis; Minnesota; William Bierman, M.D., New York.

SYMPOSIUM ON ARTHRITIS

10. **Pathologic Aspects of Arthritis**
RALPH K. GHORMLEY, M.D., section on Orthopedic Surgery, The Mayo Clinic, Rochester, Minnesota.
11. **Recent Progress in the Study and Treatment of Arthritis**
P. S. HENCH, M.D., and C. H. SLOCUMB, M.D., Section in Division of Medicine, The Mayo Clinic, Rochester, Minnesota.
12. **Physical Therapeutic Management of Arthritis**
FRANK H. KRUSEN, M.D., Section on Physical Therapy, The Mayo Clinic, Rochester, Minnesota.
Discussion: John S. Coulter, M.D., Chicago; Henry W. Meyerding, M.D., Rochester, Minnesota; J. C. Elsom, M.D., Madison.

Dinner

KAHLER HOTEL — 6 P. M.

Weekly Staff Meeting *

MAYO CLINIC — 8 P. M.

Open to members and guests attending session.

* Special subjects will be emphasized to fit in as far as possible with the program.

THURSDAY, MARCH 5

Clinics

8 to 10 A. M.
Clinic on Fever Therapy
St. Mary's Hospital
Fever Therapy Department
WALTER C. POPP, M.D., Division of Therapeutic Radiology, The Mayo Clinic, Rochester, Minnesota.

10 to 11 A. M.
Clinic on Relation of Posture to Low Back Pain Corrective Procedures
Physical Therapy Section — Museum Building
E. W. SECORD, M.D., Fellow in Orthopedic Surgery, The Mayo Clinic, Rochester, Minnesota.

11 to 12 A. M.
Clinic on General Physical Therapy
Physical Therapy Section — Museum Building
FRANK H. KRUSEN, M.D., Section on Physical Therapy, The Mayo Clinic, Rochester, Minnesota.

No Registration Fee — Physicians, their technicians and medical students cordially welcome.

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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Editor: DISRAELI KOBAK, M.D., CHICAGO

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EDITORIALS

PHYSICAL THERAPY IN FRACTURES

Elsewhere in this issue appear discussions on the indications of rest and movement as part of physical therapy in fractures which apparently are in opposition to each other. Contrast has been made with the "rest cure" of older surgeons and the modern application of motion to the effect that the results by the older method were so bad that it had become common to give guarded prognoses in fracture cases as a matter of self-protection. As this is supposed to have taken place within the present generation, it need surprise no one that older surgeons, orthopedists and even general practitioners will vehemently deny the allegations. They will assert that in the majority of instances their results were at least as good as those attained today with better facilities. And in the light of past and present experience, such a resentment will be fully justified.

The utilization of physical measures in fracture work is not new nor even as recent as some authors seem to believe. Long before the World War surgeons made it a rule to make use of massage and exercise within a reasonable period after receipt of injury. It is quite true that for many fractures it was deemed proper to delay physical exercises for about a month. Lucas Championnière preached and practiced very early application of motion in fractures on the axiom that motion is life. In spite of his fame he did not obtain many followers.

The World War gave physical therapy a tremendous impetus, but to apply the lessons gained in the occupational wards in the large general or base hospitals of all the belligerent nations to peace time injuries in a general way, is not proper. Certain factors should not be overlooked. To begin with almost all wounded soldiers who suffered from fractures could not be given the benefit of massage, active or passive motion, heat, light and other therapeutic agents for some time after receipt of injury. Indeed, military surgeons considered it an achievement that soldiers with fractured lower extremities could

be transported from the firing line to the rear with relative safety through the application of the Thomas extension splint. At the field and evacuation hospitals, through which most soldiers incapacitated for active duty had to pass, there was neither time nor the means for the systematic practice of physical therapy. What the soldiers did get before they finally reached a haven in the base hospitals was rest — rest in the splints and general rest in bed.

The brilliant results obtained in the larger base hospitals by physical and occupational therapy gave the world an insight in the value of measures that were not appreciated by the medical body politic before 1919. Yet it is not logical on that strength loosely to apply the indications established during the war to peace time fractures. Although many surgeons who served in medical units at the actual front undoubtedly saved many lives by painstaking anatomic dissections for the removal of devitalized tissues of gunshot wounds (debridement), it was not always possible to prevent ankylosis of the articulations. Any medical officer who day in day out had to subject patients to the excruciating pains incident to manual breaking up of dense adhesions, for which anesthesia could not be employed, will smile at the present day fuss made about simple fractures. One need only compare the dynamic effects of a fall or blow by a piece of machinery with those produced by a piece of shell, shrapnel or even jacketed missile hitting an extremity at a velocity of say 2,000 foot seconds, to appreciate the vast difference between war and peace wounds complicated by fracture. But even if we ignore the law of mass calculated by the square of velocity there are other factors which play a rôle in the gravity of injuries and the possibility of natural regeneration. The anatomic structures, in a histologic sense, the disturbance of physiologic function and the general health of the injured are considerations without which the term "fracture" is almost meaningless. One, to illustrate, may safely leave a simple fracture of the shaft of a long bone properly reduced and immobilized to nature and attain perfect results without bringing into action the physical therapy department of one's institution. On the other hand a comparatively lesser injury near or of an articulation involving cartilage and the synovia is certain to terminate in fibrous if not osseous ankylosis unless we support nature by physical therapy. It is here we see the futility of a schematic regime and the importance of individualization. Physical therapy is not a simple method to be ordered indiscriminately. It is precisely in fractures involving the articulations that a carefully planned and properly executed technic of a complicated nature is of utmost importance. But even the most skillful physical therapist will not obtain the best possible results without first having become thoroughly familiar with every detail of the condition he is called upon to relieve. Assuming that the responsible surgeon has secured the proper surgical situation, he must assure future success by his own cooperation with the physical therapist, who in turn must be consultant as well as collaborator.

SCIENCE, NEWS, COMMENTS

Dr. Titus Plans Radio Broadcasting for 1936 Session

The radio has played a notable part in the Congress' Annual Sessions to transmit selected portions of its transactions for the benefit of members unable to attend the convention, and for the edification of the lay world interested in the newer contributions by physical means. The 1936 session at New York in September, will include radio broadcasting on some of the important national chains in order to reach every section of the country. As pointed out in a communication by Dr. Titus, arrangements have been made to obtain all the necessary time for radio broadcasting directly from The Waldorf-Astoria, details of which will be published in the August issue of the ARCHIVES. Dr. Titus suggests that those wishing to speak, submit an early copy, because no manuscript received after July 15th can be considered. He advises that all transmission will be on all the big networks, as well as on the local New York stations. Those interested communicate with Dr. Norman E. Titus, 730 Fifth Avenue, New York.

Dr. Kovács, Tenth President of New York American-Hungarian Medical Association

As President of the New York American-Hungarian Medical Association, Dr. Kovács took occasion at the dinner and dance of the tenth anniversary celebration of this organization to cordially greet the guests and the medical and non-medical participants. His speech had the gracious quality of the wines and music of his beloved Danube. He pointed out in part that "On its Tenth Anniversary the American-Hungarian Medical Association presents a body of physicians of Hungarian extraction who have become citizens of the hospitable land of the Stars and Stripes with no mental reservations. They carry on together with their native-born colleagues their calling or promoting the science and art of healing and improving the welfare of their community according to the noblest traditions of their profession. The Association is grateful to the large number of medical and other friends who have honored it with their presence tonight and we trust that all present will enjoy an evening of fellowship and recreation to the strains of Hungarian music, the taste of Tokay wine and the sight of many beautiful women!"

Needless to say that we congratulate President Kovács on his additional distinction, and the American-Hungarian Medical Association for their election of a leader nationally recognized both for his sterling Americanism, and his brilliant scholarship in his chosen specialty.

Dr. Schmidt On Editorial Board

It is interesting to note that Dr. William H. Schmidt, head of the department of physical therapy at Jefferson Medical College has been appointed on the editorial board of the *Pennsylvania State Medical Journal.*

New York Physical Therapy Society Meets

The scientific program of the New York Physical Therapy Society was presented Wednesday, February 5, 1936, Krackowizer Hall, Lenox Hill Hospital, New York, as follows—

A.—Demonstration of Instruments.

1. Clinical Demonstration of a New Air-Spaced Cuff Electrode. *Conrad Gale,* M.D. (by invitation).

2. A New Consideration Concerning the Use of Material Interposed Between the Skin Surface and the Condenser Plates in the Short Wave Field. *Myron Schwarzchild* and *William Bierman,* M.D.

3. (a) An Interesting Relic of Early Electrotherapy. (b) A Useful Source of Dark Ultraviolet Light for Diagnostic Purposes. *Jerome Weiss,* M.D.

4. An Inexpensive Portable Ultraviolet Lamp for Treating Erysipelas. *Norman E. Titus,* M.D.

B.—Papers of the evening were:

1. Exercise in the Treatment of Arthritis. *Stella S. Bradford,* M.D.

2. Methods of Reëducation in Neurological Conditions. *Heinrich Wolf,* M.D.

Discussion opened by *Franz Groedel,* M.D. (by invitation). *C. Ward Crampton,* M.D. (by invitation).

New York State Medical Society Program Section on Physical Therapy

A special section on physical therapy of the New York State Medical Society will be held on Wednesday at 10 A. M., April 29, 1936 at The Waldorf-Astoria.

The chairman, Richard Kovács, M.D., New York, and the secretary, Lee A. Hadley, M.D., Syracuse, have arranged the following program:

1. The Formation of Vasoactive Substances in the Skin by Physical Agents. *Karl Harpuder,* M.D., New York. Discussion by: *M. C. L. McGuinness,* New York and *Jerome Weiss,* M.D., Brooklyn.

2. Physical Measures in Proctological Conditions. *Rudolph V. Gorsch,* M.D., New York. Discussion by: *F. Leslie Sullivan,* M.D., Scotia and *John C. M. Brust,* M.D., Syracuse.

3. Diagnosis and Treatment of Peripheral Vascular Disease by Physical Agents. *William Bierman,* M.D., New York. Discussion by: *G. K. Hansson,* M.D., New York and *Joseph Kovács,* M.D., New York.

4. Certain Aspects of Blood Flow. *Thomas P.*

Sprunt, M.D., Baltimore (by invitation). Discussion by: *Peter Irving*, M.D., New York and *N. E. Titus*, M.D., New York.

5. The Treatment of General Paresis by Ultra High-Frequency Heating. *Leland E. Hinsie*, M.D. and *J. R. Blalock*, M.D., New York. Discussion by: *Walter M. Simpson*, M.D., Dayton, O. (by invitation) and *William Bierman*, M.D., New York.

American Physical Education Association Convention

The American Physical Education Association will hold its 41st Annual Convention this spring in St. Louis, April 15-18, at the Statler Hotel.

Philip J. Hickey, Secretary, Board of Education, St. Louis, Missouri, announces the general theme of the session to be "Physical Education and the Enrichment of Living."

The convention is divided into the following sections: Camping, Women's Athletics, Research and Teacher Training, Recreation, Dance, Therapeutics, Administrative Directors, Men's Athletics, Health Education, Public Schools, College Men's Physical Education.

Pre-Conference Exhibits and specialized demonstrations will be staged in St. Louis, Public and private schools, college and recreation group work agencies.

Affiliated organizations are:

American Academy of Physical Education.
Society of State Directors of Physical Education.
National Collegiate Athletic Association.
Y. W. C. A. Physical Directors.
Y. M. C. A. Physical Directors' Society.
Women's Division of the NAAF.
College Physical Education Association.
National Association of Directors of Physical Education for College Women.
Administrative Directors of Physical Education.
Intra-Mural Directors.
Tests and Measurements.

California Oddities Through Eyes of Dierker

Mr. Hugh Dierker (The Dierker Corporation) is definitely California conscious. And like all of California's favorite sons, sings the praises of his adopted state. He calls attention that California is nature's most desirable region for a future scientific session of the Congress. Physiographically its length of 830 miles is equivalent to the airline distance between New York and Jacksonville, Fla., crossing the states of New Jersey, Delaware, Maryland, Virginia, North and South Carolina and Georgia.

This is but one of many distinctions of the Golden State recently tabulated by the map drafting department of the Automobile Club of Southern California. Among others were the following:

A section along the southeastern edge of the state is as far east as Calgary in Alberta, Canada.

Los Angeles is about the same distance from the equator as Bagdad, while San Francisco and Richmond, Va., and San Diego and Jerusalem are on the same latitudinal plane.

If the feat were possible, a hole drilled straight down from Los Angeles would open out in Southern Madagascar, instead of China.

San Bernardino County is four times as large as Connecticut.

The combined area of California's four national parks, more than any other state contains, is greater than that of Rhode Island.

The San Andreas Fault is the longest in the world, extending from the Gulf of California to San Francisco.

Highest and lowest temperatures ever recorded in the United States were found in California, the highest, 134 degrees, in Death Valley, in mid-summer, the lowest, on the slope of Mt. Lassen, 56 degrees below.

Truckee has the record for the heaviest snowfall in the United States.

(*Continued from page 106*)

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THE STUDENT'S LIBRARY

EINFÜHRUNG IN DIE KURZWELLEN-THERAPIE. BEHANDLUNGTECHNIK UND INDICATIONEN. Von. Dipl-Ing. *Ernst Fritsch* und Dr. med. *Martin Schubart*, Berlin. With a Foreword by Dr. A. Esau, ordentl. Professor an der Universität Jena. Cloth. Pp. 160 with 100 illustrations. Price RM. 5. Berlin: Urban and Schwarzenberg, 1935.

The mounting volume of new publications on the therapeutic value of short waves from abroad is a refutation of the ephemeral interest predicted for it and a confirmation of its increasing recognition as an important agency in medical practice. This volume represents the efforts of individuals keenly appreciative of the trend and possibilities of short waves in medicine. Their work incorporates a background of widest experience obtained from both the engineering and clinical fields during the very time when this discipline was in its formative period of development. Few are therefore prepared to discuss with greater authority than Fritsch the physical problems inherent in medical short wave radiation, and Schubart in presenting in broader strokes its clinical value. The work contains many indices to confirm this opinion. The foreword by Professor Esau is perhaps one of the most valuable documentations of the evolution of short waves in medicine in Germany. It is of historical value because it fixes the date of his own interest and contributions in this field, and explains Schliephake's later entrance and dominant contributions because of the inspiration imparted to him by Esau. The work contains at least two noteworthy contributions to the discussion of short wave therapy. The first is a critical evaluation of the type of short wave apparatus best suitable for therapeutic purposes. A detailed comparison is presented of agents utilizing radio tubes and spark gaps to produce oscillations of high magnitude and of constant or damped characteristics. According to the data presented it would seem that the former type guarantees the most efficient therapeutic results. The second deals with the type, quality and distribution of energy through electrode material. It stresses the value of air spaced electrodes and demonstrates by schematic and practical illustrations the field distribution of short and ultrashort wave radiation through phantom and clinical material. Unquestionably this section will come to be regarded as one of the most practical contributions, for it is the clearest demonstration of the action and passage of medical short waves yet presented in our literature. The discussion of clinical entities amenable to short wave is concise, but not original. It enumerates its wide scope and possibility and indicates by a rich bibliography the extent of its indications as well as limitations. Unfortunately most of the illustrations though beautiful in outline, are altogether too representative of the output of a single manufacturer not to arouse a suspicion of a modicum of commercial influence. This is to be regretted because the work in general is a valuable addition to the literature on short wave therapy.

A SYNOPSIS OF REGIONAL ANATOMY. By *T. B. Johnston*, M.B., Ch. B., Professor of Anatomy, University of London, Guy's Hospital Medical School. Cloth. Pp. 483 with 11 illustrations. 3rd edition. Price $4.50. Philadelphia: Lea and Febiger, 1935.

The intelligent use of therapeutic exercises is a valuable asset in the various types of paralysis, in the after treatment of traumatic injuries in many orthopedic and medical cases. Therapeutic exercises can be used intelligently only by one with a thorough knowledge of anatomy. This volume presents a synoptic review of the subject as contained in large text books. It is particularly valuable for a rapid orientation of particular parts before prescribing exercises. The book is practical as the explanations are concise and presented without the confusion of generalities or theories. The text is clear and excellently arranged to give a practical summary of the essentials of anatomy.

THE THEORY OF GYMNASTICS. By *J. Lindhard*, M.D. Professor at the Gymnastic Physiological Laboratorium of the University of Copenhagen and Principal of the State's Gymnastic Institute, Copenhagen. Translated from the Danish. Cloth. Price 12/6 net. Pp. 359 with 81 illustrations. London: Methuen and Company, Ltd., 1934.

Since the days of Ling the Swedish System of Gymnastics has developed enormously. Lindhard, a well known authority on the theory of gymnastics, attacks and revolutionizes the present day interpretation of Ling's views. The introduction contains an interesting discussion on the relation between athletics and gymnastics, and considers in detail the classification of therapeutic exercises. The anatomic and physiologic differences of sex and age in their relation to gymnastics are emphasized. There are fifty pages devoted to an analysis of the ordinary erect position. This discussion is the best we have. This manual contains the information which teachers of physical education should possess in order to prepare the gymnastic lessons for the day, and it can be highly recommended to all who are interested in this subject.

FROM GALILEO TO COSMIC RAYS. By *Harvey Brace Lemon*, Ph.D., Professor of Physics, The University of Chicago. Cloth. Pp. 450 with photographs by the author and drawings by Chichi Lasley. Price, $5. Chicago: The University of Chicago Press, 1934.

This syllabus has been written for the purpose of giving the students at the University of Chicago under its present history making plan of education a well knit, continuous and non-technical exposition of the important developments in physics from the time of Galileo to Cosmic Rays. Its design, style of presentation, and content are so lucid, interesting and informative as to single it out as a work that will also appeal to the lay adult who desires his scientific pabulum in equally simplified language. Written by one of unquestioned authority, the author has managed to capture and introduce here that elusive spark that fans and holds the reader's interest from beginning to end, and this on a topic that is usually composed of desiccated technicalities. As pointed out by Lemon, "there is in physical science . . . a large body of material, universally accepted by all well-trained and critical scholars, with which the layman, even if he has been formerly 'exposed' to its conventional courses for the brief time of a crowded academic year, is quite as unfamiliar as he is with the arguments for and against a pulsating universe. This material is the solid substance of science, proved, checked and cross-checked." To do justice to this thesis while presenting it in a style to arouse sustained interest, required the special gift and rhetorical talents of the born teacher. The syllabus is an extraordinary index that Professor Lemon in spite of modest denials is endowed with such talents, for he has demonstrated how a highly technical subject can be made to throb with new life and interest. He has told by words and by simple but fascinating illustrations, rather than by formulas, the story of developments that have occurred in the realm of physics since the time of Galileo. In spite of the fact that it is a narrative about "things largely unseen and entirely analytical," it is nevertheless presented with authenticity and without distortion or exaggeration with respect to its factual content. The book is divided into five sections, namely, (1) mechanics, (2) heat, (3) electricity and magnetism, (4) electricity and matter, and (5) waves and radiation. This book will be found especially valuable to those in the medical profession interested or specializing in physical therapy, x-ray, or radium.

THE 1935 YEAR BOOK OF GENERAL SURGERY. Edited by *Evarts A. Graham*, A.B., M.D., Professor of Surgery, Washington University School of Medicine. Surgeon-in-Chief of the Barnes Hospital, etc., St. Louis. Cloth. Price, $3. Pp. 838 with 206 illustrations. Chicago: The Year Book Publishers, 1936.

This review of the surgical literature for the past year has maintained the editorial policy and format of preceding annuals which have been reviewed in this journal. The editor this year devotes several pages to a review of the outstanding contributions of the year, the text proper being devoted to general, special (regional) and orthopedic surgery. While the bulk of the abstracts is of American origin, many worth while foreign contributions have been judiciously selected. With about a thousand articles having been reviewed, it is clear that surgery is not resting on its laurels and that both experimental and clinical studies are kept up by earnest workers. On the other hand we find very little about electrosurgery, the paucity being somewhat offset by a controversy between Pribram, of Berlin, and Thorek, of Chicago, on the question of the proper manner of coagulating the base of diseased gall bladders. Physical therapy in connection with the literature on orthopedic surgery is conspicuous by its absence. General surgeons and physicians interested in surgical problems may rely on the volume to provide the year's output by many workers in all lands, and as no one is expected to read all surgical journals one has the year's literature at his elbow. The index could have been enlarged to contain every author's name mentioned in the text, a few omissions being noted. A list of the surgical journals from which articles have been abstracted may prove of interest to many. It is also suggested that the editor present a list of good surgical books and monographs that have appeared during the year. Finally — and this is in the nature of a request rather than a suggestion — the editor should not be so parsimonious with his critical comments, for the few he does make will undoubtedly be accepted as authoritative, especially in moot problems. The publishers are to be congratulated on the service they have rendered the profession for a number of years.

INTERNATIONAL ABSTRACTS

Scientific Status of Physical Therapy in Otology. A. R. Hollender.

Laryngoscope **45**:471 (June) 1935.

The author calls attention to the fact that the literature of the past fifty years contains numerous references to the therapeutic employment of light, heat and electricity in a number of aural diseases. He reviews the uses of the galvanic current, and while he realizes that it has been advocated for various aural diseases, he contends that sufficient evidence is not available to place it on a sound scientific basis. Galvanic ionization is of value in definitely indicated cases, provided that it is correctly applied.

For the uses of infrared and luminous ray therapy in otology, one must of necessity first assume that heat as a therapeutic agent possesses value. For the acute catarrhal or suppurative types of otitis media, infrared radiation greatly increases the relief afforded the patient, but should not be used as a substitute for surgery when the latter is indicated. Infrared has, in addition to otitis media, proved beneficial in the external types of otitis, notably furunculosis.

As regards ultraviolet ray therapy, there is some virtue in it for certain selected cases of chronic otorrhea which fail to yield to other measures. There is, however, only one process in the middle ear for which light therapy is virtually a specific — tuberculosis. Resolution of protracted healing of mastoid wounds can be hastened by local and general ultraviolet radiation. Chronic meatal dermatitis, eczema, lupus and erysipelas have been benefited by this therapy.

Diathermy is of value only in the serous types of middle ear deafness. Experiments on animals have, however, demonstrated the correct technical application of the high frequency current to the auditory apparatus. Short wave therapy has been available too brief a period to allow of conclusions at this time. Surgical diathermy has a rather wide field of usefulness in otology, both for benign and malignant growths.

When one considers the unscientific manner in which physical therapy has been treated in the past, some of its advances are obvious and noteworthy. Its failures in otology are due primarily to a lack of training and experience. Nor should treatment be left to the technician, unless the otologist masters and supervises correct technical application. The tendency of referring incurable cases to the physical therapy department is hardly a just practice. Likewise, dependence on physical medicine for psychological effects, without proper justification, is unworthy of scientific otologists.

It is scarcely necessary to point out, that with the present imperfect status of physical therapy in otology, further research should be encouraged. As each day passes improved apparatus become available, and with improved facilities at our command, advances in our field become reasonably probable.

The requirements for an unhindered progress in this newer branch of therapeutics can be outlined in two brief statements:

1. Openmindedness on the part of the medical profession in general and the otolaryngologist in particular.
2. Encouragement of the pursuit of problems in physical therapy on a basis equal with that of all other problems in otology.

The author's conclusions are:

1. Physical therapy should not be heralded as a cure-all in otology but rather as an aid to methods which for many diseases have been inadequate.
2. The chief value which the galvanic current offers in ear treatment is in ionization of selected cases of chronic otorrhea.
3. Infrared radiation is of definite benefit in acute inflammations and infections of the external and the middle ear.
4. Ultraviolet rays are reliably employed in otologic practice for middle ear tuberculosis and for eczemas, lupus and erysipelas of the external ear.
5. Diathermy in otology is still a controversial problem, but experimental studies have established a correct technical application of this agent which should be utilized for further investigation.
6. Recent scientific work has to a large extent removed physical therapy from empiricism to a state of rationale.
7. Physical methods while not revolutionary in otology have, nevertheless, added to our therapeutic knowledge and effectiveness and merit openmindedness and impartial consideration by every progressive members of our specialty.

Fulguration and Electrodesiccation. E. P. Cumberbatch.

Practitioner **135**:71 (July) 1935.

There appears to be some uncertainty as to the nature of the treatment called "fulguration" by some writers, and "electrodesiccation" by others. Occasionally it is also confused with diathermic coagulation. In fulguration the tissue is killed by heat derived from sparks. The heat does not penetrate far below the surface. Its action is chiefly on the fluids of the tissue. They are evaporated or even boiled away, leaving a dry residue. In electrocoagulation the lethal effect is due to the heat which the current generates in passing through the tissue and overcoming its resistance. The tissue is heated

en masse until it coagulates. Coagulated tissue is moist.

Treatment by electrodesiccation has its limitations. Only those parts which are accessible with the active electrode, can be treated. If the abnormal part is covered by skin or mucous membrane it cannot be reached without desiccating the healthy overlying tissue. It is unsuitable for the treatment of large masses of tissue or those that extend more than about one centimeter below the surface.

Various kinds of benign growth and other abnormalities of the skin and accessible mucous membranes, such as papillomas (pigmented and non-pigmented), corns and warts of different kinds, various types of nevus, pigmented areas of the skin, keloid, clavus, leucoplakia, tuberculous nodules, hemorrhoids and rodent ulcers have been successfully treated by electrodesiccation.

An Artificial Fever of 111.4 Degrees F. as a Means of Destroying Cancer in the Animal Body. George Walker.

Am. J. Can. **25**:301 (Oct.) 1935.

The author demonstrated that scirrhous carcinoma of the mammary gland could be destroyed *in vitro* at a temperature of 111.4 degrees F. The method of determining this point was to cut the tumor into very fine pieces, heat in Locke's solution up to a temperature of 111.4 degrees F. and then with a small trocar implant a modicum of it into a rat. In none of the animals did any tumor grow. On the other hand, when pieces of the same tumor were implanted without having been heated, a tumor resulted in each instance.

The temperature of the whole animal was also raised to 111.4 degrees F. and maintained for twenty minutes. The etherized animal was put into a thermostat, the temperature of which had been raised to 104 degrees F., while the atmosphere had been saturated with water vapor up to 98 per cent. This humidification was effected by hanging a number of small pieces of gauze in the chamber and immersing their lower fourths in a small basin of water on the floor of the thermostat. A thermometer was passed through an opening in the thermostat and introduced into the rectum of the animal quite close to the opening, so that the reading could be made from the outside. The temperature of the animal rose quite rapidly and uniformly, at a rate of 1 degree F. every three minutes. When the desired temperature (111.4 F.) was reached, it was kept nearly constant by opening and closing the door. Later it was found unnecessary to raise the temperature of the box above 100 degrees F. At this point the dissipation of heat by evaporation from the mouth and lungs was interfered with by the humid air, and the animal's temperature was elevated by its own heat production.

The animals, as a rule, lived through the period of twenty minutes at a temperature of 111.4 F., but died soon afterwards. Two recovered sufficiently to crawl around, drink water and survive for ten hours after their removal from the thermostat. Up to the present, however, exposure to this temperature proved uniformly fatal. Raising the temperature to 109 degrees F. at repeated intervals did not destroy the tumor nor does it seem to retard the growth. The artificial fever produced by the high frequency apparatus appears to be more damaging than the artificial fever produced by the thermostat. There seems to be something especially injurious in the high frequency method, for in no instance did the animal live as long as the required twenty minutes after the temperature reached 111.4 degrees F. The construction of a large thermostat, in which it would be possible to maintain a temperature of 100 degrees F. with complete saturation of the air with water vapor, might offer a safer method of producing artificial fever than the use of the high frequency apparatus.

Ionization of the Nasal Mucosa. Relationship Between Reagins in the Blood and Effect of Treatment. Preliminary Report. H. L. Alexander, and J. H. Alexander.

J. Allergy **6**:240 (March) 1935.

The procedure of ionization offers an opportunity to observe how soon and under what circumstances the newly formed epithelial tissue may become sensitive. It was surmised that if the reagin content of the blood persisted, sensitization would soon return. On the other hand, if no reagins could be demonstrated, the process of new local antibody formation would probably be slower. There are other possibilities to explain relief of symptoms, but the above only was investigated.

Patients were treated at the Washington University Out-Patient Department after a routine allergic history was taken and a careful otorhinologic examination was made by a member of the staff. This included a study of nasal secretions in which the relative number of eosinophils was noted. Intradermal skin tests were made and positive reactions measured with a planimeter and recorded in square centimeters. Only decidedly positive reactions were recorded. Reagins were sought for by the nasal technic of passive transfer of blood serum to normal skin. Blood eosinophilia was determined. The nose was then ionized, and reexaminations by the above procedures were recorded at the end of two weeks and at three months. In a few cases observations were made at the end of six months. In some patients topical application of allergens which had caused trouble was made to the nasal mucous membranes before and after treatment.

As a result of ionization, the size of the initial direct skin reaction did not change materially. The size of the passive transfer test was somewhat variable, but this may be attributed to the fact that the recipients were changed.. Ward patients were used, so that a repetition of the test at three months was almost always done on

a different skin which may have been more or less receptive than that upon which the first transfer had been done. Blood eosinophilia was not particularly altered, and it is interesting that eosinophiles persisted in the nasal secretions, even in those patients who were relieved. The significance of this finding is not clear. Topical applications of allergens gave variable and inconsistent response.

It is perhaps noteworthy that of the nine patients who secured no relief, eight had hay fever, and of these seven showed demonstrable reagins. On the other hand, in the group of 11 that were relieved, including five patients with hay fever, in only three were reagins found.

Electrosurgical Extirpation of Xanthoma. Report of Two Severe Cases. Lewis J. Silvers.

J. A. M. A. **105**:796 (Sept. 7) 1935.

The author reports two cases of xanthoma palpebrarium planun in twin sisters. The affection was an unsightly, extensive involvement completely encircling the eyes. Treatment with monochloracetic acid produced prompt recurrence. Electrodesiccation was used following infiltration anesthesia. The small pointed needle electrode provided a fine millimeter sized spark. Ten ambulant treatments completely eradicated the chamois-like growth. The author warns against the use of the biterminal electrocoagulation method, to prevent scarring effects.

The Rôle of Electropyrexia in the Fight Against Veneral Diseases. Heinrich F. Wolf.

Bull. Am. Hosp. Assoc. **9**:86 (Oct.) 1935.

The outstanding usefulness of hyperpyrexia lies in the treatment of gonorrheal infection. The reliability of this form of treatment is far greater than that of salvarsan in syphilis. There is absolute uniformity in the publications on the treatment of gonorrhea by hyperpyrexia. Even the percentage of cures is practically the same. Those who use the most efficient methods for producing fever can boast of practically 100 per cent cures; in acute gonorrheal arthritis they are 100 per cent. In chronic cases with joint destruction no results can be expected, as the bacteria in these cases have already disappeared and hyperpyrexia, which kills the gonococcus, has no effect on the regeneration of joint tissue.

Expense is one difficulty which stands in the way of general application. While the cost of equipment could be disregarded as far as the patient is concerned, the cost of a single treatment cannot. The average duration of a treatment may be figured at four hours, and with the necessary rest, seven to eight hours. Such treatments can only be given at a price which must be considered prohibitive for a large part of the population, even if we consider the fact that the treatments may bring about a permanent cure. As a rule several treatments are required.

Diathermy in the Treatment of Pneumonia. F. W. Schwarz.

Bull. Vet. Admin. **12**:167 (Oct.) 1935.

Eighteen cases were treated with diathermy at the Veterans Administration of Camp Custer, and all with the same pleasing results. These results have led to these conclusions: In the presence of a fever and pulse and perspiration rate expected in pneumonia, a high leukocyte count, with distant breath sounds, pain, dyspnoea, or other pulmonary discomforts — if these symptoms and signs are acute — diathermy should be immediately instituted.

Photodynamic Sensitization: Biological Action and Therapeutic Application. Albert Eidinow.

Proc. Royal Soc. Med. **28**:633 (March) 1935.

Photodynamic sensitization may be defined as the mechanism by which the chemical composition of living cells may be altered following their exposure to rays of light, which normally in themselves have no specific chemical or biological action. Experimentally it is possible to sensitize living cells to infrared, luminous, ultraviolet rays and x-rays by the use of selected specific chemical substances, such as metallic salts, organic dye stuffs, etc., known as light sensitizers.

Selective action for each group of rays, from the infrared to the long ultraviolet region of the spectrum, was obtained by suitable choice of sensitizer. Further, the secondary radiations or fluorescent rays excited by exposure of chemical substances to x-rays or long ultraviolet rays were of sufficient intensity to cause biological reaction. In living animals two degrees of reaction were obtained. Large doses of sensitizer and intensive irradiation caused death of animals from "acute light stroke"; smaller dosage and weaker irradiation produced mild local and general reactions. The latter could be applied for therapeutic measures, and the dosage controlling these two reactions can be determined by preliminary test *in vitro*, by studying the haemolysing power of the sensitizer employed on a 2 per cent suspension of red blood corpuscles in saline. Thus with eosin, a concentration of 1: 1,000,000 equals 10 mgm. per kilogramme weight, will cause mild therapeutic sensitization but stronger doses — 1:10,000 to 1:30,000 — may cause death of the animal after exposure to a powerful source of visible rays. The use of chemical sensitizers gives intensified and prolonged reactions similar to ultraviolet irradiation but penetrating to a deeper zone through the skin and subcutaneous tissue. The normal white skin absorbs and reflects infrared, luminous and ultraviolet rays. The absorption of rays of light by the skin is the method by which radiant energy acts on the human body, and it may be stated that the metabolism of light occurs in the normal skin. The degree of penetration and reflection varies in different parts of the body and is different for each individual wavelength of light. The long infrared rays are absorbed by the most superficial layers of skin, the short in-

frared, orange and yellow rays penetrate deeply through the skin to the blood vessels and underlying subcutaneous tissue. Sonne has shown that the short infrared and luminous rays can heat the tissues at 0.5 cm. depth from the skin surface to 47.5 C., and he found that this temperature was 5 degrees C., higher than that of the skin surface. The blue-violet luminous rays do not penetrate beyond 20 mm. and are mostly absorbed by the hemoglobin in the superficial blood capillaries. The longer ultraviolet rays are totally absorbed in the surface layers of the skin and cause a bluish-green fluorescence of the normal white skin. Ultraviolet rays of wavelength shorter than 3,100 A. U. are absorbed by living epithelial cells and excite photobiochemical reactions which cause latent erythematous reactions, and other biological actions, such as vasodilatation, intradermal and subdermal polymorphonuclear leucocytosis and the activation of vitamin D from ergosterol present in the lipoid substances of the skin cells and secretory glands. The intensity of erythema produced by irradiation of the skin with light sources emitting ultraviolet rays of wavelength shorter than 3,100 A. U. varies with the depth of pigmentation present, the thickness of the horny layers of the epidermis consisting of dead or predesquamated skin cells, and the fat content of the skin. The condition of the local circulation and the temperature of the skin at the time of irradiation influence erythema reactions. The age of the skin cells plays a considerable part, for the skin is a rapidly regenerating organ, and as the chemical nature of the skin cells alters with age, they become more opaque to ultraviolet rays and therefore lessen the degree of erythema reactions. In childhood ultraviolet erythema reactions cannot be normally demonstrated until the second or third year of life. In the aged, the skin is hypersensitive to irradiation. Conditions of severe anemia and ill health weaken the reaction of the skin cells to ultraviolet irradiation.

Under normal conditions the infrared and luminous rays have only a transient action on the normal skin; these rays are absorbed or reflected by the epidermal cells and heat is conducted to the circulatory blood vessels and deeper structures. Excessive absorption of heat will naturally cause blistering and necrosis of the irradiated tissues. The blood vessels show an immediate response, vasodilatation and an irregular area of skin erythema being produced. After the cessation of irradiation this reaction gradually subsides and the tissues return to the normal state.

The increased blood circulation of the irradiated skin can be demonstrated many months after ultraviolet irradiation, for if 0.01 grm. of histamine is injected subcutaneously, the portion of skin which has received ultraviolet irradiation will stand out and show a bright red flushed area in contrast to the normal non-irradiated skin.

Light pigmentation may occur either after the single application of an erythema dose of ultraviolet rays or may result from repeated applications of weaker ultraviolet irradiation, which does not cause visible skin erythema. In the early phases pigmentation is produced by the displacement of pigment from the deeper skin cells to the surface. Later, with the regeneration of the skin cells, pigment is found in the basal epidermal cells. The capacity of the skin to develop pigment varies with the hereditary nature of the skin cells; brunettes, as a rule, pigment more strongly and more rapidly than blondes. The different regions of the skin react with unequal intensity; the naturally darker pigmented areas of the skin cause stronger pigment reaction to ultraviolet irradiation. Pigmentation is a chemical process and originates through the action of a ferment, an oxidase, present in the epithelial cells, acting on a colorless precursor of the skin pigment melanin, dioxyphenylalanin. The irradiation of the skin increases the activity of the oxidase ferment and changes dioxyphenylalanin to melanin. In cases of vitiligo and leucoderma this pigment reaction is absent, although these skin areas are often more sensitive than the normal skin to ultraviolet irradiation. It has been suggested that the ultraviolet rays which cause erythema of the skin are not necessarily of the same wavelength as the pigment-forming rays. The nature, intensity and color of the pigment found in the skin varies with the intensity and nature of the source of ultraviolet rays which is employed.

The Use of Electrocoagulation in the Treatment of Rectal Carcinoma. Walter A. Fansler.

Lancet **55**:495 (Aug. 1) 1935.

Electrocoagulation presents distinctive advantages over other methods of treatment. It can be used in the majority of rectal carcinomas where radium may be indicated, and in some to better advantage, such as large cauliflower growth attached to the circumference of the rectum and filling its lumen. In this type of tumor the mechanical difficulty of properly spacing radium implants is very great. On the other hand, with electrocoagulation these large tumors are actually destroyed. The coagulated tissue is removed so one can accurately determine at the time of treatment just what has been accomplished in the way of tumor destruction. Another advantage is the absence of prolonged pain or serious toxic symptoms which sometime arise following radium therapy. With flat lesions where the radon seeds may be accurately spaced the results are more satisfactory. Results, however, are equally good with electrocoagulation without the danger of prolonged after discomfort or toxic symptoms.

The following types of cases are the best to be done by electrocoagulation:

1. Early lesions, preferably a low grade of malignancy, either pedunculated or flat.
2. Cases in which old age or other physical impairments would contraindicate radical abdomino perineal or perineal methods of excision.
3. Inoperable cases, particularly large growths which are producing distressing rectal symptoms.
4. Case with partial or complete obstruction due to large rectal growths.

SHORT WAVE DIATHERMY

A Comparative Study in Pelvic Heating

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This study was undertaken to ascertain to what degree short wave diathermy could heat the female pelvic organs. Much has been claimed for short wave generators, not the least of which is their power of selective heat production. We are in agreement with Mortimer and Osborne[1] that heat alone is probably responsible for the therapeutic effects which short wave generators produce. Therefore if they are able to produce heat in the deeper body structures that is all that should be expected of them. This at present is a question of much controversy. It is quite true that with inorganic substances and non-living tissues a selective heat production can readily be demonstrated. This has been done by Schliephake,[2] Mortimer,[3] and more recently by Bachem.[4] Mortimer clearly showed, however, by experimentation that in the living animal the selective action was no longer true, owing to heat dissipation by an extremely efficient circulation acting as a heat regulating mechanism. For this reason alone one should not interpret phantom experiments in relation to the living body. Mortimer and Osborne were not able to demonstrate any selective heating effect. Schultze-Rhonhof and Rech[5] took the temperature of urine filled bladders, the uterus, vagina and the rectum, following treatment with short wave generators. They used wavelengths varying from six to thirty meters. These investigators stated they could find no evidence of pronounced heat. Ewerhardt,[6] at Washington University Medical School, St. Louis, has been conducting an investigation in pelvic heating and with virtually the same findings as our own.

Nine subjects and twenty-nine observations were used in this study. Insofar as was possible each generator was used in rotation on each subject. Table 1 shows the number of tests made on each of the nine subjects. Five machines made by different manufacturers and of the following wavelengths were used in the experiments: 9 meters, 15 meters, 16.4 meters, and 24 meters. The fifth machine was an electromagnetic generator which heats by electromagnetic induction. It had a wavelength of 25 meters. Each patient was given an arbitrary twenty minute treatment. Twenty minutes was chosen because this is the usual time devoted to the average treatment in clinical practice. We found that the maximum temperature is reached in less than twenty minutes. The maximum temperature attained is apparently that point where the rate of heat generation and the rate of heat dissipation by the circulating blood are equalized. During treatment each patient was covered with a light sheet. A specially constructed air bulb thermometer, which would not be affected by high frequency fields, was used for measuring temperature in the vaginal vault. The air bulb made of pyrex was embedded completely in the vaginal vault and its circumference was such that the vaginal canal was slightly dilated. The thermometer was calibrated against a Bureau of Standards thermometer. The instrument was calibrated before and after each experiment. Rectal and mouth temperatures were taken with a clinical thermometer.

With short wave machines the so-called double pad or through and through technic was used, that is, the pelvis was between two suitably sized electrodes. This was the only available technic, inasmuch as no orificial

TABLE 1. — *Showing the Number of Observations Made on Each Subject*

Subject	Observations	No. of Machines Used
1	5	5
2	5	5
3	4	4
4	4	4
5	4	4
6	3	3
7	2	2
8	1	1
9	1	1
Total — 29 observations.		

electrodes were provided for use with these generators. The pads belonging to each machine were applied as instructed by its manufacturer. The pad electrodes were the usual rubber pads and varied from forty to sixty square inches in area. A towel in addition to a suitable thickness of felt was placed between the skin of the patient and the electrodes. The felt gave a suitable spacing and also assisted in the absorption of perspiration so that the surface heating was less ucomfortable to the patient. Much difficulty was experienced with surface heating except when the electromagnetic field was employed. The discomfort to the patient nearly always was so intense that the full output of the machine could not be maintained throughout the entire treatment without the danger of a burn. This accounts for the inability of short wave apparatus using condenser type electrodes to heat appreciably the deeper tissues. This seems to be a most undesirable and limiting factor of most short wave electric field generators. The electromagnetic generator does not use electrode pads but instead a heavily insulated flexible conducting cable. This method of tissue heating has been adequately described by Merriman, Holmquest and Osborne.[7] These authors[8] have also described the technic of application. The double pancake coil technic was used. The cable was wound in the shape of a double pancake coil each consisting of three turns and wound in the same direction. One coil was placed beneath the patient under the buttocks with a towel and one layer of felt of one-fourth of an inch between the coil and the patient's skin. The other coil was placed over the lower quadrant of the abdomen so that the pelvic organs were between them. A layer of felt and towel was placed between coil and skin. Care was exercised that the cable connecting the two coils, and passing laterally over the trunk, did not contact any part of the body. This method of treatment was by far the most comfortable for the patient. Another great advantage is that if the intensity of the current has to be reduced, it can be accomplished without throwing the circuit out of resonance. Heating efficiency is therefore always at the peak.

The complete data of all the experiments are given in Table 2. Figure 1 shows in graphic form the average initial temperature, the average increment of temperature, and the average final temperature secured in the vagina, rectum and mouth. As a standard of comparison we feel that the final temperature attained is of far greater significance than the mere temperature increment. We have therefore selected the average final as our means of comparison. The electromagnetic field produced the highest temperatures in the vagina with an average final temperature of 101.9 or 1.9 degrees F. higher than the next machine (table 3). The short wave generators heated to about the same level ranging from an average final temperature of 99.4 to 100 degrees F. (table 3). In the rectum, the highest temperature was produced again by the electromagnetic field with an average final of 101.3, while the short wave field ranges from 99.5 to 99.9 lagging by 1.4 degrees F. The mouth temperature, as might be anticipated, did not show much change. Table 3 shows that the electromagnetic field had an average final temperature of 99, which was shared with one short wave machine, the other three generators ranged between 98.5 to 98.7, which in two instances was no

TABLE 2. — *Measurements of Pelvic Heating*

Patient	Temp. °F.	ELECTROMAGNETIC FIELD			24 METERS			16.4 METERS			9 METERS			15 METERS		
		Vaginal Temp.	Rectal Temp.	Mouth Temp.	Vaginal Temp.	Rectal Temp.	Mouth Temp.	Vaginal Temp.	Rectal Temp.	Mouth Temp.	Vaginal Temp.	Rectal Temp.	Mouth Temp.	Vaginal Temp.	Rectal Temp.	Mouth Temp.
Subject No. 1	Initial	98.7	99.2	98.4	99.5	99.6	98.0	98.8	99.2	98.4	98.8	98.8	98.4	99.1	99.2	98.4
	Final	100.9	100.0	98.4	100.0	99.6	98.6	99.3	99.2	98.4	99.3	99.2	98.2	99.7	99.7	98.6
	Rise	2.2	.8	0.	.5	0.	.6	.5	0.	0.	.5	.4	—.2	.6	.5	.2
Subject No. 2	Initial	99.1	.....	.....	98.8	99.4	98.8	99.1	99.0	98.8	99.0	99.2	98.9	99.0	99.4	98.8
	Final	101.4	.....	.....	99.6	99.4	99.0	99.7	99.4	98.6	99.7	100.0	99.0	99.9	100.2	99.2
	Rise	2.3	.....	.....	.8	0.	.2	.6	.4	—.2	.7	.8	.1	.9	.8	.4
Subject No. 3	Initial	98.9	99.2	98.4	99.3	99.5	98.4	99.2	99.2	98.6	99.1	99.4	98.6	.....	.....	.....
	Final	100.0	100.2	99.2	100.5	99.9	98.0	99.9	99.8	98.6	99.6	99.8	98.8	.....	.....	.....
	Rise	1.1	1.0	.8	1.2	.4	—.4	.7	.6	0.	.5	.4	.2	.....	.....	.....
Subject No. 4	Initial	99.5	100.0	98.5	99.5	99.4	98.8	99.3	99.4	98.8	100.0	99.6	99.0	.....	.....	.....
	Final	101.9	100.8	99.2	100.5	99.6	98.8	99.6	99.6	99.0	101.0	99.8	99.0	.....	.....	.....
	Rise	2.4	.8	.7	1.0	.2	.0	.3	.2	.2	1.0	.2	0.	.....	.....	.....
Subject No. 5	Initial	99.3	98.8	98.0	99.6	99.6	98.6	99.3	99.4	98.4	99.5	99.6	98.6	.....	.....	.....
	Final	104.4	104.2	99.4	100.7	99.6	98.6	100.3	99.4	98.4	100.6	99.6	98.6	.....	.....	.....
	Rise	5.1	5.4	1.4	1.1	.0	.0	1.0	0.	0.	1.1	0.	0.	.....	.....	.....
Subject No. 6	Initial	99.0	99.3	98.2	99.1	99.2	98.6	99.6	99.6	98.5	.....	.....	.....	.....	.....	.....
	Final	102.9	102.6	99.0	100.0	99.4	98.6	100.6	99.6	98.8	.....	.....	.....	.....	.....	.....
	Rise	3.9	3.3	.8	.9	.2	.0	1.0	.0	.3	.....	.....	.....	.....	.....	.....
Subject No. 7	Initial	98.9	98.6	98.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	99.5	99.4	99.2
	Final	102.0	100.0	98.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.	1100.0	99.2
	Rise	3.1	1.4	.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.6	.6	.0
Subject No. 8	Initial	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	99.4	99.3	98.8
	Final	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.2	99.6	99.2
	Rise	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.8	.3	.4
Subject No. 9	Initial	.....	.....	.....	98.5	98.4	97.8	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Final	.....	.....	.....	99.2	98.7	98.2	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Rise	.....	.....	.....	.7	.3	.4	.....	.....	.....	.....	.....	.....	.....	.....	.....
Number of Observations		7			7			6			5			4		

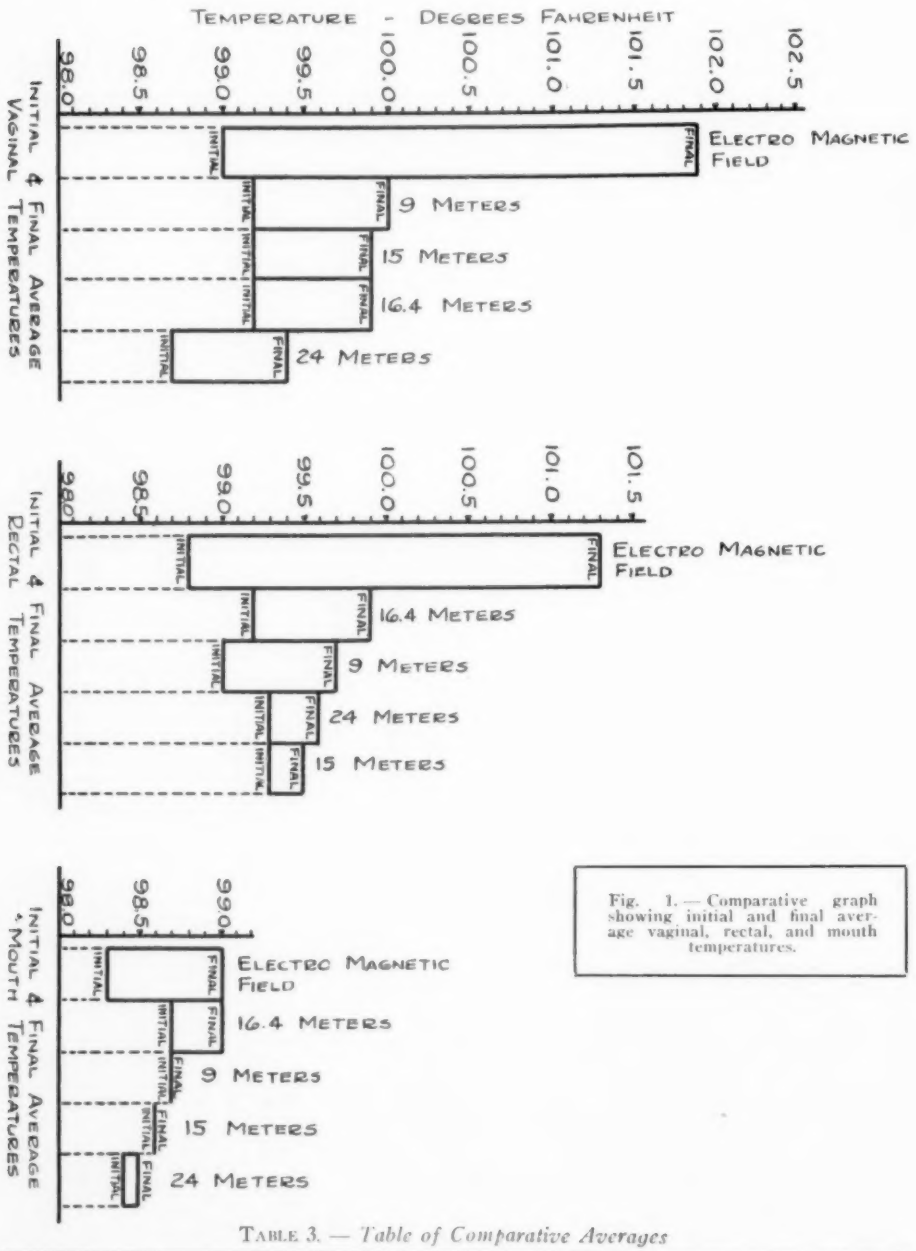

Fig. 1. — Comparative graph showing initial and final average vaginal, rectal, and mouth temperatures.

TABLE 3. — *Table of Comparative Averages*

Averages of Sata		Electro-Magnetic Field 25 Meters Average of 7 Observ.	24 Meters Average of 7 Observ.	15 Meters Average of 6 Observ.	9 Meters Average of 5 Observ.	16.4 Meters Average of 4 Observ.
Vaginal	Initial	99.0	98.7	99.2	99.2	99.2
Temperature °F	Final	101.9	99.4	99.9	100.0	99.9
	Change	2.9	.7	.7	.8	.7
Rectal	Initial	98.8	99.3	99.3	99.0	99.2
Temperature °F	Final	101.3	99.6	99.5	99.7	99.9
	Change	2.5	.3	.2	.7	.7
Mouth	Initial	98.3	98.4	98.6	98.7	98.7
Temperature °F	Final	99.0	98.5	98.6	98.7	99.0
	Change	.7	.1	No change	No change	.3

change from the initial temperature and 0.1 degree F. difference in the other. The only significance of the increase in mouth temperature is, of course, that the blood has been warmed.

This investigation was not undertaken as a clinical evaluation of this method of treatment but to find out whether it is possible to produce heat in the pelvic organs. This question we have endeavored to answer. Its clinical value has been left for others to determine. However, in our opinion the time of application in clinical practice should be longer than twenty minutes.

Summary

1. Vaginal, rectal and mouth temperature measurements were made before, during and following treatment with short wave diathermy.

2. Generators were used giving 15, 16.4, and 24 meter wavelengths. In addition an electromagnetic generator of 25 meters was used.

3. The electromagnetic field gave the most comfortable treatment to the patient.

4. The electromagnetic field produced the highest temperatures. The short wave generators all produced heat to about the same degree.

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Eastern Sectional Meeting of American Congress of Physical Therapy

The Eastern Sectional meeting of the Congress will be held in Philadelphia, May 27, 1936. While more detailed information will be printed in the April issue of the ARCHIVES, the following preliminary program is presented:

1. Physical Therapy in the Treatment of Arthritis, *John delP. Currence,* M.D., New York. 2. Physical Therapy in Orthopedic Conditions, *Jerome Weiss,* M.D., Brooklyn. 3. Fever Therapy in Office Practice, *G. J. P. Barger,* M.D., Washington, D. C. 4. Dangers of Over-Treatment in Physical Therapy, *M. C. L. McGuinness,* M.D., New York. 5. Treatment of Erysipelas with Ultraviolet Energy, *Norman E. Titus,* M.D., New York. 6. Temperature of the Surface of the Skin, *William Bierman,* M.D., New York. 7. Influence of Short Wave Radiation on Constituents of the Blood, *Disraeli Kobak,* M.D., Chicago.

TRANSURETHRAL PROSTATIC RESECTION

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AND

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The two methods generally employed in the transurethral removal of prostatic obstruction are (1) resection by means of a high-voltage cutting current applied through a movable, wire loop, and (2) the punch operation, with or without preliminary electrocoagulation. The former method is at present most widely used. Comparison of the results of the two methods shows, however, that the mortality, morbidity, and secondary complications are distinctly less with the punch operation than with resection by the cutting current.

In order to remove tissue with a cutting electric current, as employed with a wire loop, tissues beyond the line of cleavage become destroyed to a variable extent, and secondary necrosis and excessive bleeding and secondary infection frequently follow. The punch operation, particularly if made with the "cold knife" punch, is attended by less trauma to the surrounding tissues than any other method. The electric energy employed is a damped high-frequency, coagulating current. It is applied by multiple needles inserted into the prostatic tissue and left there for a few seconds before each bite is taken with the tubular knife, for the purpose of preventing excessive bleeding from cut tissues. In glands which are not very vascular this may be dispensed with. Individual, bleeding vessels are controlled by touching them with the coagulating current applied through a Bugbee electrode. Postoperative bleeding and secondary infection are usually much less severe and the tissues heal more quickly than following resection with the cutting current.

Status of Transurethral Prostatic Resection

The present status of opinion among urologists concerning transurethral prostatic resection is a very curious one. On the one hand there are those who condemn the procedure and say that surgical prostatectomy is the only method to employ. In support of this opinion urologists point to the high mortality and the unfortunate complications following transurethral resection in the hands of unskilled operators. In some cases they have tried the transurethral operation and, after a short and unfortunate experience, have given it up as a bad job. Then there is that considerable group who maintain that the transurethral method should be used only in cases of prostatic obstruction of minor degree and with small glands of the commissural type, and that in most cases of prostatic obstruction complete prostatectomy is indicated. "Choice of procedure to fit the case" is their motto. On the other hand most urologists who have had extensive experience hold that transurethral prostatectomy, if correctly employed, has many advantages over conventional prostatectomy. They may have had unsatisfactory re-

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 11, 1935.

sults in the first fifty or hundred cases in which resection was performed, but with continued experience they developed a high degree of skill and now have good results.

Suffice to say, when a method has been developed which is attended by a mortality of less than 1 per cent, which requires a stay in the hospital of only five or six days in most cases, and which usually permits the patient to return to his home and carry on his work at the end of two or three weeks, there can be no question as to its merits. Transurethral resection, if correctly employed, is incomparably the best method of removing prostatic obstruction. In fact, judging from our experience at the clinic with more than 2,000 patients who underwent resection in the past five years, surgical prostatectomy is almost a forgotten procedure and there is seldom any excuse for its employment. Why anyone suffering from prostatic obstruction would prefer to undergo complete prostatectomy, with its higher operative risk, with the morbidity usually six or eight times as long, and with the increased danger of postoperative complications and persistent secondary infection, is difficult to understand.

Resection Not a Simple Procedure

It should be stated most emphatically, however, that transurethral resection of the prostate gland is not a simple procedure. Some men seem to think that the only requisites for successful resection are the latest model resectoscope, a cystoscopic table, and a patient who is willing to remain still while the method is tried. Transurethral resection should be employed only by one who has been trained under the guidance of an expert, and then only after considerable experience. In addition, a thorough knowledge of the anatomy of the vesical neck and adjacent structures, and ability to recognize the various abnormal tissues, are essential requisites. It is also essential that a careful system of rigid asepsis be maintained before, during and after the operation, since secondary infection may cause serious if not fatal complications. It is also necessary that preoperative and postoperative care be carried out with the aid of skilled assistants and technicians, who should keep the patient under observation continuously for the first day or two. In addition, a corps of specialists in the various phases of medicine should be available for consultation, not alone in the course of preliminary examination, but in case complications arise after operation. With a set-up of this kind, in the hands of an experienced operator, the mortality, including advanced risks, should be approximately 1 per cent and the morbidity an insignificant factor. During the past two years transurethral resection was performed at the clinic in 1,070 cases, with seven deaths, or a mortality of much less than 1 per cent.

It is true that many of the patients observed at the clinic have come for examination and treatment shortly after the onset of symptoms of urinary obstruction. As a result, many of the glands resected are enlarged only to a moderate degree. In the majority of cases in which resection is carried out, however, there is a marked degree of prostatic obstruction and the amount of residual urine usually varies from 100 cc. to complete retention. Included in the latter group are many patients with advanced renal damage as shown by clinical evidence of renal insufficiency and by a blood urea varying from 100 to 300 mg. per 100 cc., or only a trace of phenolsulphonephthalein in the urine. Many of these patients were more than seventy years of age and some, more than eighty. Various complications, which usually contraindicate surgery, were found, such as advanced cardiac disease, pulmonary complications, malignancy in other portions of the body, postoperative urinary fistulas, and psychoses.

It is interesting to note how our views have changed in regard to the preliminary treatment of patients with prostatic obstruction. It is rarely that we find it necessary to leave a retention catheter in longer than a week or ten days. The urethral catheter usually remains in the bladder only until the value for blood urea is less than 40 mg. per 100 cc. or has become stabilized. If the renal function is within normal limits, preliminary drainage is dispensed with except as necessary to relieve the patient's distress while his general examination is being conducted. Preliminary suprapubic drainage may be advisable — in an occasional case with marked urinary retention and severe renal insufficiency in which catheter drainage is not adequate and a long period of drainage is found imperative — to restore renal function. However, the number of cases requiring suprapubic drainage is much smaller than formerly; during the past year at the clinic, we found it necessary in only 6 per cent of the cases observed with advanced obstruction.

Postoperative Course

We do not want to give the impression that the postoperative course following transurethral resection is always uneventful and that complications seldom occur. Among the possible complications the following may be mentioned: (1) Hematuria, persisting after operation or delayed, (2) infection, persistent pyuria or dysuria, and (3) inability to urinate, as a result of residual prostatic tissue or of an atonic bladder. With this list of possible complications, the advisability of resection might be questioned. However, these complications occur in comparatively few cases, and they can be obviated or controlled by intelligent observation and treatment without interfering with a successful result. It will be of interest to go into detail in considering some of these complications and the methods of treatment that we have found to be of value. The following observations are based on experience with transurethral resection in a series of almost 2,000 cases.

Hematuria following resection is of two types, namely, that which persists after operation and that which occurs some time later. Hematuria persisting after resection is usually due to one or two bleeding vessels which have not been adequately controlled by electrocoagulation, or because the remaining prostatic tissue is of an oozing type. Slow hemorrhage which persists after resection is usually controlled by the introduction of a number 24 catheter, which is allowed to remain twenty-four to forty-eight hours, depending on the degree of bleeding. It frequently happens that, following resection, some of the remaining prostatic tissue will be displaced into the lumen of the neck of the bladder or urethra, become congested, and bleed. If the hematuria does not gradually stop, or if it persists to an alarming degree, it may be advisable to reëxamine the vesical neck after several days and to electrocoagulate any bleeding vessels, or if necessary, resect remaining tissue. Late bleeding sometimes takes place from three to four weeks after resection. While this should happen in probably less than 1 per cent of cases, when it does occur it may be an alarming complication, since the patient has been allowed to return to his home prior to this time. Control of the bleeding is usually simple enough. After evacuation of the clots from the bladder and visualization of the spurting blood vessel which is usually present, simply touching it with the electrode applied through the cystoscope ordinarily is sufficient to stop bleeding.

Inability to empty the bladder following resection may be due to several factors, the two most common being residual prostatic tissue, causing obstruction, and atony of the musculature of the bladder. Occasionally both factors may be present. Not infrequently there is congestion in the prostatic

tissue immediately following resection, sufficient to cause temporary obstruction. If the patient does not void satisfactorily after removing the catheter on the morning of the third day after resection, the catheter is inserted at the end of six hours and removed again the following day. In this way the atony of the detrusor muscles is gradually overcome and normal function will be established unless there is residual obstructing tissue. If the patient is unable to void after repeated attempts, secondary resection of remaining prostatic tissue may be found necessary within a week after primary resection.

When a second resection is indicated, it is accomplished with comparative ease, as it is necessary to remove a comparatively small amount of tissue, following which the patient usually has little reaction. Sometimes it is wise deliberately to plan a resection in two stages if the gland is very large. This is done to avoid too much surgical shock to aged patients, as we do not feel justified in prolonging a resection beyond forty-five minutes to an hour. The second resection is usually carried out seven to ten days after the first. Secondary resection was done in 127 cases, or 11.8 per cent of resected cases. It was found necessary to remove obstructing prostatic tissue a third time in only a very few cases, other than those in which carcinoma was present. If, on inspection, no obstructing prostatic tissue remains, inability to empty the bladder can be ascribed to weakness of the detrusor muscles. Secondary atony of the vesical musculature sometimes takes place as a result of long-standing stretching and it may be several weeks before the normal function of the musculature returns. In some cases Thompson[1] has found that stimulation of the vesical musculature is possible by injecting a 1:1000 solution of gentian violet into the bladder and allowing it to remain. In some cases there may be a very small amount of tissue remaining in the sphincteric area, which may not cause actual obstruction but may be sufficient to cause sphincteric dysfunction. Resection of this tissue and a period of intermittent catheterization usually will restore the function of the bladder to normal.

Unless the operator is thoroughly familiar with the cystoscopic anatomy of the trigone, vesical neck, and prostatic urethra, invasion of the periurethral or perivesical tissues may easily take place. If these tissues should be invaded, secondary urinary infiltration may result, with fatal complications unless immediate suprapubic drainage is established. Necrosis of periurethral tissues may follow electrocoagulation by the loop method, with subsequent stricture, urethrorectal fistula, or incontinence. Since prostatic tissue and fascia usually surround and protect the trigone almost as far as the interureteral ridge, the danger of invading the perivesical tissues is not very great if certain anatomic boundaries are respected. Thompson[2] has clearly stated that care should be taken not to remove tissue within 1 cm. of the interureteral ridge or within 1 cm. of the verumontanum. Excision of prostatic tissue too close to the verumontanum will endanger the external sphincter. With these two landmarks in mind, the complications referred to can be largely obviated.

Pyuria following resection usually disappears in from two to six weeks. When it persists for a longer time after resection, it may be explained by remaining infected prostatic tissue, or by infection in the bladder, or upper part of the urinary tract which had been present prior to operation. Postoperative infection in the prostatic urethra or bladder is often improved by the administration of 1 grain (0.065 gm.) of methylene blue three times a day, and in some cases by lavage of the bladder with a solution of potassium permanganate. Marked prostatic infection existing before resection may be the cause of postoperative dysuria and pyuria, which may be very difficult to

eliminate. In cases in which an abscess of the prostatic duct was present at the time of resection, the drainage established by the operation may be a large factor in eradicating the infection. However, in occasional cases prostatitis persists in spite of every form of treatment and, although the bladder is completely emptied, dysuria and pyuria may persist. It should be remembered that the results following surgical prostatectomy in the presence of marked infection in the prostate gland were even more unsatisfactory. There is no advantage to be gained in enucleating this type of gland, since the percentage of patients who recover and the improvement shown are greater following resection than prostatectomy.

Late Results

It is too early to make any definite statement in regard to the late results following resection, but as far as we have observed, they should compare favorably with those which have been obtained by prostatectomy. In making this statement it is presumed that resection will have been done thoroughly, and that obstructing prostatic tissue will have been cleanly removed from the neck of the bladder. It has been our observation that transurethral resection has frequently been done with the idea of removing only the superficial obstructing portions of the gland. Although symptomatic improvement will often follow inadequate resection, urinary retention eventually recurs in many cases and gives an erroneous impression of results which usually follow thorough resection. Based on the results with patients who underwent resection three or more years ago, recurring obstruction has been observed in less than 2 per cent of our cases. Regrowth of prostatic tissue subsequent to adequate prostatic resection has been observed in only a very few cases. We are convinced that prostatic hyperplasia reaches a certain stage and then ceases, and that removal of the obstructing portion of the prostate gland is not followed by further regrowth except in very few cases.

Conclusion

Transurethral resection, in the hands of a skilled operator, is the method of choice in removing prostatic obstruction. The low mortality (less than 1 per cent) and the limited morbidity (hospitalization of less than a week), which accompany the procedure, if correctly employed, are quite in contrast to the postoperative results of conventional prostatectomy. The best results can be obtained by means of the knife punch, with preliminary hemostatic coagulation. The poor results following transurethral resection, which have been cited in the literature, should not be attributed to the procedure. Such results are due to lack of knowledge and skill.

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BIOMECHANICS

New Method of Studying Physical Disabilities *

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NEW YORK

Biomechanics, as the name implies, is the adaptation of mechanical engineering methods to the clinical and research study of human and animal tissues. Steindler has devoted many years to the development of this problem, and it may be appropriate to state that now three groups are working under his direct supervision.

The group from Columbia University, which I have the honor to represent, have chosen for their special study the fibrous tissues of mammals. The particular phase of this investigation is on the fibrous tissues of the lower back and thigh, clinically applied to the study of certain cases of low-back pain. It is emphasized that this is only a preliminary report and that the new methods presented are to be considered merely as a supplement to established methods of treatment.

It is our hope eventually to present anatomic and histologic studies of the fibrous tissues of the lower back and thigh comparable to the classical work of Kanavel's in his study of the fascial spaces of the hand. It may be stated that low-back pain has received a tremendous amount of study and that the clinical results have been far from satisfactory. A great many cases, in spite of the most extensive work-up, are admitted to be unsolved problems. It is common knowledge that the residue of this group of cases constitute a major disability and a major economic loss.

Cause of Low-Back Pain

The fundamental principle on which this investigation is based is that we believe that the fibrous tissues of the lower back and thigh, if their functions are disturbed, are capable of causing pain and serious disability. Clinical research has been limited to a small number of cases, but we are under the impression that the diagnostic possibilities and the therapeutic results, while as yet inconclusive, indicate that our original premise may be correct.

Our researches have already successfully measured in engineering units certain properties of fibrous tissues. These determinations have been considered in relation to the known functions of such tissues, as follows:

1. The transmission of normal stresses and strains between the component parts of the locomotor apparatus.
2. The support either of organs or groups of organs.
3. The facilitation of free movement of one structure in relation to another.

The first research was the determination of the strength and elasticity of fibrous tissues in terms of the transmission of normal stresses and strains. The standard engineering measure of elasticity is according to Young's modulus. Young was a practicing physician in London. This work is shown in figure 1.

It is of particular interest that the fibrous tissues of a carefully selected cross-section of mammals thoroughly checked, show great uniformity of strength and elasticity.

We will not dwell on these tests further except to state that they have

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 9, 1935.

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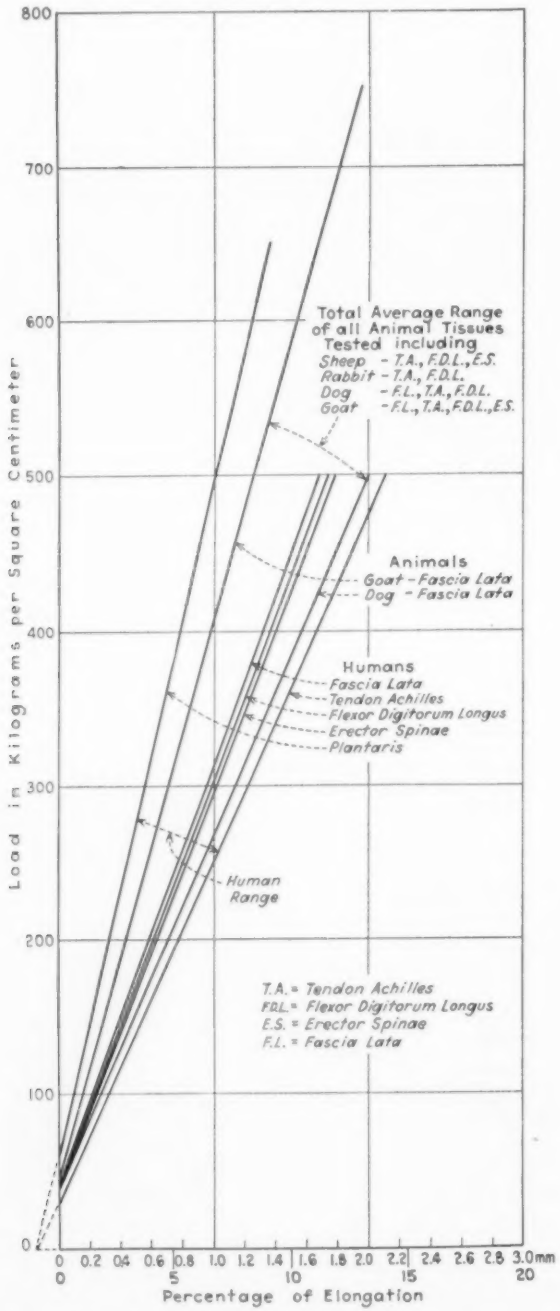

Fig. 1. — Summary of results of tensile tests of fibrous tissues.
(Graphs are not plotted beyond proportional limit. Data from tissues resulting in curved graphs are not included.)

been carefully controlled and are sufficiently accurate to warrant other research workers in using this data.

Just as mesodermal tissue is capable of forming joints between bones, fascial planes which are also mesodermal in origin, form joints between individual muscles and groups of muscles. These joints between muscles are potential spaces situated in the fascial planes of the body and are comparable

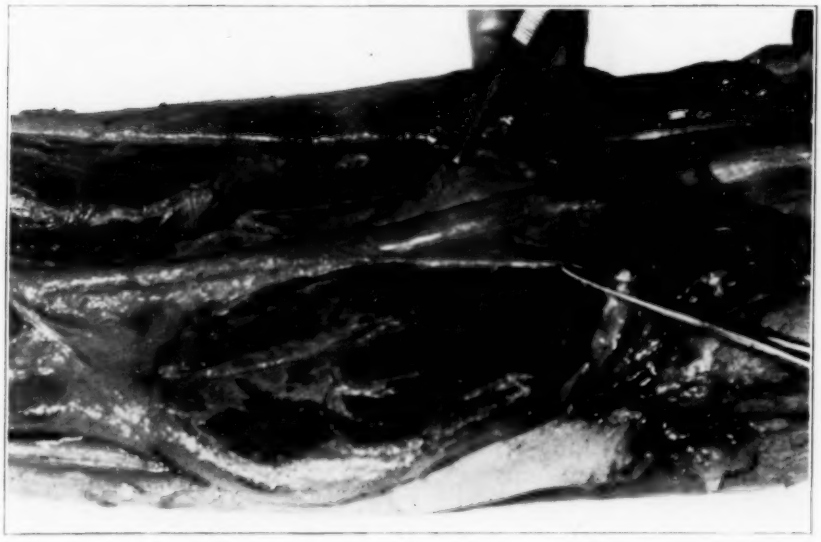

Fig. 2. — Fascial covering of the sciatic nerve demonstrated. Note absence of adhesions.

to synovial spaces elsewhere. It is most unfortunate that one of the pioneers in the study of the anatomy of the fascial planes, Prentiss of Iowa State University, died without publishing his labors of years on the anatomy of these spaces. The author wishes to express his appreciation for the personal help and encouragement given to him by Joseph Milgram, of New York, one of Prentiss' associates, who was also a former associate of Steindler's.

Fig. 3. — Adhesions of the fascial covering in the sciatic nerve.

The preliminary work on the anatomy of the fascial spaces of the thigh and lower back, in particular relation to the sciatic nerve, is shown in figures 2 and 3.

Our group of workers had great difficulty in determining the exact anatomy of these spaces until the cadaver specimens were injected with air, and the lantern slides, herewith presented, were obtained in this manner.

It was noted in our cadaver work that air so injected remained in the spaces up to one month, proving that the potential fascial spaces were practically air-tight. The anatomic and histologic work has shown such progress

Fig. 4. — Fascia spaces of the shoulder showing the even distribution of the air.

Fig. 5. — Note the irregular distribution in this arthritic patient in contrast to the normal.

Fig. 6. — The irregular distribution noted in an arthritic patient.

that we were encouraged to attempt the study of fascial spaces clinically. Actual visualization of tissues is of tremendous advantage in any clinical study. It is hardly necessary to recall the marked advances made in the diagnosis and treatment of affections of osseous tissues since radiography renders these tissues accessible to visual study.

Radiographic Studies

Certain radiographs are presented in which air was used as a contrast medium and the fascial spaces thereby visualized. These are technically known as pneumofasciograms.

It is hoped that the use of this simple technic may permit further progress in soft tissue radiography, and at the same time add to the interest in fascial surgery which is as yet in its infancy.

The radiographs herewith presented were obtained in this manner (figs. 4 to 7). Using this method purely as a diagnostic procedure it was noted that many cases of arthritis, and patients with sciatic pain, show fine multilocular adhesions in their radiographs. In such cases a spectacular temporary relief of symptoms followed this diagnostic measure. The psychic element was reduced to a minimum by explaining to all patients that we were merely using a new technic for x-raying muscles and fasciae and that pain must be expected to follow it. One series of cases was treated with air injection alone, and another series with short wave diathermy preceding the injection of the fascial spaces and the injection was followed by massage and also short wave diathermy. While these two series are as yet too small to report in detail, the first was therapeutically unsuccessful while in the second group a marked relief of symptoms was obtained. It should, however, be stated that the work was first done clinically in April, 1935, and we can not, as yet, state anything as to the permanency of the results obtained. It is the author's belief, confirmed by radiographs, and also by a very careful study of a small number of cases of obscure pain, that adhesions in the fascial spaces may be the causative factor of the symptoms. From our anatomic study we know that the nerves and blood vessels traverse these spaces and hence the symptoms of pain may be accounted for by minute adhesions in

Fig. 7. — Radiograph showing the normal distribution of air in the fascial spaces of the thigh and in the lumbodorsal fascia.

the spaces rather than by a pathologic process in the nerve itself. This condition, which was regarded as an infection of the synovial covering of muscles, was called myosynovitis.

It should, however, be emphasized that this work at the present time is largely of a diagnostic nature and in terms of biomechanics, is a study of nature's methods of permitting motion between muscles and muscle groups, and that the permanent therapeutic effectiveness of such treatment has not yet been determined. However, the two small series of cases would seem to indicate that combined with a rational program of physical therapy it may be of clinical significance.

In conclusion we desire to plead with the various groups of the medical profession to support Steindler's efforts to establish biomechanics on a more scientific basis. I further sound a note of caution as to the possible dangers and unfortunate sequelae which may follow indiscriminate methods of injecting the fascial spaces of the human body.*

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* I desire to express my appreciation to the groups which made this work possible. I am indebted to the Bell Telephone Laboratories, the American Society of Mechanical Engineers, and to the Departments of Pharmacology and Surgery of Columbia University, particularly Dr. Blackberg. The work has been thoroughly checked from an engineering standpoint by Professor G. B. Karelitz of the Department of Mechanical Engineering, Columbia University, and Mr. Wegel, of the Bell Laboratories.

Discussion

Dr. Arthur Steindler (Iowa City, Iowa): It isn't very easy for me to give, in a few words, an expression of my appreciation of Dr. Gratz' work and due credit for what he has done so far. The more I ponder the more I am amazed at the possibilities which open themselves in a study of the mechanics of the soft tissues of the locomotor system. I do not want to fall into a sort of reverie, but I should say that unless we have a pretty clear conception of the functional mechanics of the soft structures which form part of the locomotor system we will not be able to go much further in the management of the legion of conditions which arise from the disturbances of these structures. It is necessary to look upon these sub-structures with the eyes of an engineer, as my dear old friend, Dr. Prentiss, has taught us, and to apply engineering principles to the mechanism of locomotion of the soft tissues among each other.

It is a long time since the skeletal system was taken in hand, so to speak, and with the advent of the x-ray we have arrived at a respectable degree of accuracy in our conception of its mechanics. There was nothing seen in the literature until very recently that similar progress has been made so far as the soft structures are concerned, and yet the mechanical situation is infinitely more intricate and delicate and, of course, much more difficult to analyze.

What do we know about the stress and strain resistances of the ligaments? What do we know about when they do tolerate them and when they don't? Do we know how they act if they do not tolerate them, and what happens from the pathologic aspect if they do not?

We have very little knowledge of it in spite of the fact that this problem entails a legion of ailments which have baffled us and which have caused much disappointment.

Dr. Gratz, whose work I have followed with a great deal of interest, has enthusiastically entered into problems of this kind and made the study of the soft structure mechanics of the locomotor apparatus his principal objective, and he has shown us in slides some of the investigation which he has carried out with mathematical accuracy. Today he has stepped out of this larger setting and has approached us with a very pointed and definite problem, the low back pain and the sciatic syndrome, in a manner to show its practical application. The question suggests itself, how can one accept his view when there have been so many explanations of the low back pain and all have fallen down? That is true. They have fallen down; for instance, the lumbar transverse system, trophism, sacralization, the cleft first lumbar, and what not. But if we go back to the literature we see that they have been built on hypotheses based on morphological evidence without even a plausible interpretation, and thus have failed to prove it clinically.

Encroachment of the intravertebral foramina is a different matter. This is seen in the cadaver where one can observe the nerves coming out of them. The inference is logical that there must be some causal connection between some of the intercostal root pains and this particular condition. I think in point of logic this particular instance is of greater value. Even so, if we follow the number of cases of sciatic radiation, for instance, or low back pain, there must be a considerable number which do not fit into this explanation on the basis of our clinical experience.

Most of us advocate manipulation of backs and quite often the patients get relief. It is up to us to establish the causal connection between the relief and any existing pathologic process. If we can't answer the question, we are "in the red." There are a number of cases which cannot be attributed to nerve root compression, and with more analytic penetration, we might anticipate an additional explanation. After all, Dr. Gratz has come to the finding of a condition which we should have suspected by virtue of the fact that our explanation of the sciatic radiation did not cover all or not even most of the cases.

Consequently, when he is able by air injections, perfected by his method, to show there is actually a constriction of the sciatic nerve within its perineal sheath, we have ample reason to accept his theory. I have seen the adaptation of the soft tissues of the locomotor apparatus to strained conditions many times. You see adventitious and bursal development, although they are never described in the textbooks because they arise under the stress of circumstances. Many have operated on the sciatic nerve and found neural adhesions. These adhesions are much more frequent than suspected, and therefore the investigation of this simple fact is most likely to open up a possibility in cases of sciatica which have not been explainable under the assumptions I have mentioned. The mere fact that patients get better after the stretching should lead us to think that there must be some impediment in the course of the sciatic nerve.

Dr. Theodore P. Brookes (St. Louis, Mo.): The vast amount of investigation with its scant results to which the essayist refers makes us realize that much groping has been done in the region of the lower back. Such studies as Dr. Gratz's give a satisfactory sense of searching with specific purpose and reasonable hope for definite progress in this admittedly confusing field of pathology. If he can add to the known classification another 10 or even 1 per cent of cases that may be pocketed, as it were, and given relief, the profession will owe him a debt of gratitude.

Progress along diagnostic lines is intriguing, but as a clinician I am especially impressed by the associated thera-

peutic possibilities. Dr. Gratz carefully and rightly warns against overenthusiasm, but there is more than a ray of hope in this work. It is well known that the pain of joint conditions is in large part due to changes in periarticular tissues. Multilocular adhesions in fascial or intramuscular planes present reasonable explanation. Air or solutions injected into such "myo-synovial" spaces may well separate adhesions.

A similar explanation is offered for the relief secured by Evans, of London, after his intra-thecal or extra-dural injection of normal saline in cases of so-called idiopathic sciatica. Last month I found Dr. Kountz, of Washington University School of Medicine, using extra-dural injection on a series of cases with sciatic pain. Some were due to definite changes in the spine. Yet they secured a degree of real relief. Its permanency remains to be determined. He tells me that the solution injected into the thecal canal at the lower end of the sacrum enters the posterior extra-dural space of the spinal canal, pushing not only the cord forward, but also the spinal roots. It is thought that such displacement of the roots may break up fine adhesions about them. After all, many believe that the idiopathic sciaticas are actually residual nerve involvements from original injury or disease about the roots. There must be many adhesions about such a nerve trunk or root. Injection of air or solution into multilocular adhesions about a nerve trunk or between muscle planes is a fascinating field to consider in physical therapy. On myself I am sure I would prefer the latter.

Dr. William Bierman (New York): During the past few years we who have been particularly interested in physical therapy have seen advertised very extensively, particularly in the literature abroad, the use of a preparation known as octozone. That, presumably, was a gas containing an O^8 radical. Every chemist I spoke to lifted his eyebrows whenever that was mentioned. I bring up this consideration to ask Dr. Gratz whether it is permissible to use some gaseous medium other than air. I thought possibly some of the results which have been claimed for the injection of octozone might be explained on the basis of the work to which Dr. Gratz has called our attention. That was injected by means of a needle into the muscles and about joints.

I wondered, too, when he came to the discussion of the therapeutic application of some of his considerations, just how it was he got into the particular spaces involved. He told us that these air spaces are air-tight. I would like to know how much air he injects and how much goes into that particular space if he aims for it. Isn't there a rupture of muscle fibers?

I have been very much impressed, in the little work we have been able to do, with the physiologic reactions to some of the mechanical procedures we use. What happens in the way of the reaction of capillaries, or lymphatic spaces? I know he has thought about it, and I know it takes years of work to go a little beyond the purely mechanical concept of what one does.

I was impressed, too, with the statement he made that he found therapeutically that he secured better results from the combined application of heat, such as short wave, massage and the injection of air. I would like to know, if he hasn't already done so, whether he could run control experiments injecting air in one, injecting air plus physical therapy procedures in another, and physical therapy procedures in the third group.

I would like to ask his opinion, too, of one other procedure. We have in physical medicine an agent called the static current. It is a current of extremely high voltage, but its physiologic response has thus far been entirely ignored. There is one physiologic response which is exceedingly interesting, namely, very vigorous contraction. I am not aware of any current which will give as vigorous muscular contraction as the static current with comparatively little discomfort.

The older clinicians have been wont to treat low back pains by a combination of some form of heating energy, the radiant source or diathermy, or short wave currents if they were working in these days, followed by the use of static spark which causes a very vigorous contraction. There is no question about it; if you have ever tried it, you will see how you can make muscles fly into contraction by means of the wave current or the spark.

Several years ago I had the opportunity of presenting before one of the local component societies of this national organization the question of the use of combined heating energy and static spark in the treatment of low back pain, and we formulated a theoretic concept concerning which I would like Dr. Gratz' opinion. That concept was this: We did not consider that the pathology was purely a mechanical one. You may recall, in Dr. Gratz' presentation this afternoon, that in speaking about one of the patients, an x-ray of whose neck he showed you, he said attention was paid to the removal of infected teeth and, I suppose, other foci of infection. That fits in with the theoretic concept of our own, namely, that possibly many of these local lower back pain conditions may be due to areas of infection, possibly due to streptococcus which is anaerobic, and that possibly the physiologic response to some of these physical therapeutic procedures consisted of increase in the local circulation and possibly an increase in the percentage of oxygen within the tissue in which the organisms were present. That is a purely theoretical concept, but I bring it to you because I feel Dr. Gratz will tell us more of the physiologic responses to a mechanical procedure such as the injection of air.

Dr. David H. Kling (Los Angeles, Calif.): Dr. Gratz' findings are of great interest especially his conception of the presence of the minute interstitial spaces

as joints. Even if his definition is in contradiction with the orthodox definition of "joints," it would greatly strengthen his conception if we could demonstrate the presence of specific secretory cells in the lining of these spaces, which are identical with the synovial cells of the joint membrane.

I have demonstrated in extensive studies that these specific cells secrete mucin, which gives the synovial fluid its characteristic viscid appearance and its significant functions, namely, lubrication and protection of the joint surfaces. The presence of mucin was found in all normal and in over 95 per cent of the pathologic joint fluids. It is demonstrated by a simple test, namely, the formation of closed tubes and sacs on addition of diluted acetic acid to the synovial fluid. Vaubel using these reactions could prove that as long as synovial tissue cultures remain healthy — production of mucin is present, but it disappears as soon as degeneration sets it. The prevailing conception that the synovial fluid is a degeneration production or a filtrate from the blood circulation is therefore disproved beyond doubt.

Dr. Gratz' research makes it seem probable that also the interstitial spaces are a gliding mechanism between the muscles and it is probable they also contain cells which secrete a lubricant in the nature of mucin, which is the most widely distributed protective and lubricating matter in the animal kingdom.

Dr. Charles M. Gratz (closing): Many interesting points have been raised and I shall endeavor to answer as many of them as possible. Dr. Kling's suggestion of studying the content of these joints should, if carried out, prove of tremendous scientific interest. Histological examinations of the lining of these spaces should, as he suggested, be more carefully studied. I am fully in accord with having a thorough examination of all patients and adequate care of any foci of infection before a diagnostic procedure of this type should be used. If these conditions are caused by the streptococci which is anaerobic and the injection of air tends to check the effect of this organism specifically it would naturally lead to a great improvement in the treatment. I personally do not feel that we have done sufficient work to even suggest claiming such a theory. I do, however, believe, and have found, that physical therapy following injection is of great value.

I would also wish to make clear the premise that this is primarily a diagnostic rather than a therapeutic procedure and is designed to supplement rather than to repiace other methods of treatment. The technic has not been sufficiently worked out to give in detail except to state that we never inject in any one location more than 1 cc. of air for each two pounds of body weight. In applying the research work already done to the problem of low back pain in the sciatic syndrome, the utmost conservatism must be exercised because of the number of theories which have been advanced, and as Dr. Steindler has shown, have not proven clinically successful. While I appreciate very greatly what Dr. Steindler has said about the application of this work I sincerely hope that clinicians will realize that nerve symptoms may arise from disturbed functions of the nerve due to adhesions in the fascial covering.

In conclusion I would plead for a conception of the functional mechanics of the soft tissues by clinicians. One more word of caution. This procedure is not without serious risk of infection and embolism and should be done as a hospital procedure only.

A FLEXIBLE ELECTROSURGICAL UNIT

ALFRED E. JONES, M.D.

CHICAGO

The instrument shown in the accompanying illustration consists of a hard composition handle made pliable by the insertion of a flexible rubber covered goose-neck, carrying a chuck tip to permit the attachment of the various cutting loops, blades and coagulating discs. The conducting cord is connected by a swivel joint permitting free rotation of the electrodes.

The instrument was devised by Mr. Richard Hocking, chief technician of the physical therapy department of the Michael Reese Hospital. It is

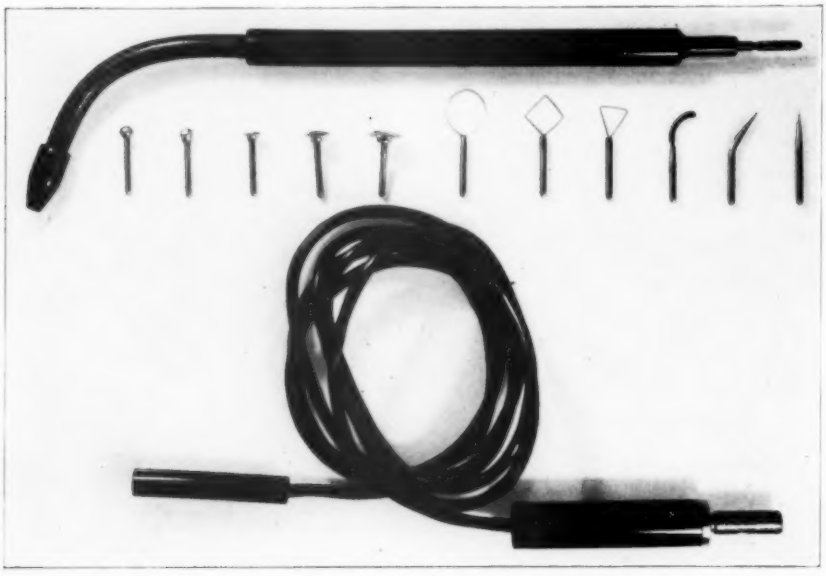

Fig. 1. — Electrode handle, cord and various types of cutting units.

especially helpful in bladder surgery, but also readily lends itself to electrocoagulation of rectal malignancies.

108 N. State St.

COLONIC LAVAGE IN TREATMENT OF DISEASE *

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Colonic therapy as a specialized system has been gaining steadily for the last few years both in scientific approval and in popularity. This does not mean however that it has not had many difficulties to overcome.[1] Orthodox medicine is slow to accept innovations of any kind, and more particularly those hailing from the empiric and discarded past. Nevertheless the findings of men trained in scientific methods and observations, who have devoted years of study and research to some special problem honestly and disinterestedly, cannot be disregarded. It is the result of these studies, sifted, appraised and applied, that is bringing order out of chaos in the realm of colon lavage. Though agreement is practically complete on all fundamental principles there are still some differences of opinion in the matter of technic. For the present colonic therapy may be defined as a system of treatment of disease both local and general by the use of colon irrigations and instillations together with the use of such other auxillary means as may seem indicated. On the other hand the indiscriminate and unintelligent use of colon irrigations as isolated acts without planned therapeutic purpose, merely to produce a thorough evacuation of the colon, is not colonic therapy.

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Section on Colonic Therapy, Kansas City, Missouri, September 10, 1935.

Basis of Colonic Lavage

The claims of colonic therapy for recognition and continued existence rest upon the following premises:

1. That the colon is a common focus of infection and its lumen a breeding place for a large variety of bacteria.
2. That toxins, native proteins and bacteria readily pass through the intact mucous membrane of the colon and are taken up by the capillaries and lymphatics.
3. That the functional threshold of detoxification of the liver is frequently overstepped, permitting these substances entrance into the general circulation.
4. That the mesenteric lymphatic system becomes overtaxed and inefficient, finally permitting bacteria and their toxins entrance into the receptaculum chyli.
5. That as a result of liver damage, portal stasis occurs, resulting in the shunting of bacteria and toxin-laden blood through the inferior hemorrhoidal veins into the general circulation.
6. That a symptom complex variously designated as autointoxication, chronic intestinal toxemia and chronic focal infection with their many manifestations and complications thereby ensues.
7. That the systems and methods of therapy now in use are inadequate to cope with this condition.
8. That there is both a need and a demand for a more effective therapeutic régime.
9. That colonic therapy meets this need more adequately than any other system of therapy at present known.

The fact that the colon is a common focus of infection is so thoroughly established and supported by such a volume of unassailable evidence that it seems almost superfluous to attempt to defend this contention. However, incredible as it may seem, there still are physicians of eminence and influence who deny this fact. In the first place colon infection is the *sine qua non* of acute and chronic appendicitis. It is the source of the great multitude of secondary infections in the kidney, pelvis, gallbladder, perirectal tissues, in which the colon bacillus is found in pure culture. Albee[2] states that it is the primary focus in 90 per cent of cases of myofascitis; Burbank[3] maintains that it is generally the primary focus in all cases of chronic atrophic arthritis. Lieb[4] says, "Our experience justifies the conclusions that focal infections, primarily outside the alimentary tract, play a statistically minor rôle in the production of chronic disease and that wherever the primary infection may be, secondary infections of the gastrointestinal tract may eventually develop through hematogenous or gravitational sources." Carnett[5] says: "There is no doubt that toxins and bacteria carried in the portal circulation may cause pathologic conditions in the liver and gallbladder, but there is no good reason to believe that these noxious agents originate in a comparatively small sclerosed appendix rather than elsewhere in the large sewage system of the intestinal tract." Rehfus[6] avers: "There is no reasonable doubt that the colon bacillus in some forms at least, is capable of exerting intense pathology. That there are many varieties of the colon bacillus is conceded by bacteriologists." Kolmer[7] mentions the colon bacillus as one of the great causes of chronic infection.

Although many may concede that the lumen of the colon harbors myriads of bacteria as well as the chemical decomposition products of food residues, some of which are exceedingly toxic if absorbed in sufficient quantity, not so many are willing to concede that these bacteria are capable of invading the tissues or that absorption of harmful substances takes place under ordinary

circumstances. The mucous membrane of the colon is believed to be a faultless defense barrier, a perfect protection against all harmful substances present in the bowel. It is however merely the first line of defense and is far from being faultless. Abundant evidence is at hand to show that not only do water and the products of normal digestion enter the capillaries and lacteals of the intestinal tract, but also that bacteria[8, 9] and native proteins,[10, 11] and any or all of the products[12] of their activity or cleavage may pass through the intact mucous membrane of the ileum and colon. Furthermore there is no true selective absorption in the sense that desirable substances are accepted and undesirable ones refused. It is true that at different levels we observe differences in speed of absorption but this action is determined largely by mechanical factors and not by differentiated mucosal cells. However, Combe[13] claims that an antitoxic function of the mucosal cells has been proved by experiments carried out by Queirolo, Heidenhain, Charrin and Tedeschi. At the same time he mentions factors operative within the intestinal lumen designed to limit the formation and absorption of harmful substances. Among others he mentions the normal secretions such as bile and mucus, the acidity of reaction, dryness of the fecal material in the distal colon which in itself limits putrefaction. While not believing in selective absorption of substances by the cells of the intestinal mucosa, Combe did believe in their selective action in the destruction of toxins, and that the liver, the second line of defense, destroyed toxins spared by the first, forming thereby a "reciprocal completion." The evidence he offers in support of this contention appears to be trustworthy.

The Colon in Abnormal Conditions

Inasmuch as it has been shown that the first line of defense is not always faultless even in a state of health, it requires no flight of the imagination to picture the massive absorption that must take place in many abnormal conditions, such as increased putrefaction, breaks in the continuity of the mucous membrane, and lowered resistance and disturbed function of the cells of this membrane. The most important organ in the second line of defense is the liver. Acute temporary increases in the toxic load carried by the portal vein such as commonly occur following a cathartic in conditions of stasis or infection, or following dietary indiscretions or a cold, will cause the functional threshold of detoxification to be overstepped with the result that a sudden shower of unchanged toxins and bacteria will enter the general circulation. This results in a "bilious attack," "acid condition," "toxic state" or other acute indisposition. Any sustained increase will sooner or later permanently damage the detoxifying and bacteriolytic functions of this organ. Kantor[14] states, "It is well known that so long as the liver remains competent, it forms a very effective barrier between poisons known to arise in the intestine and the general circulation." Mann[15] states that the liver protects the body from certain toxic substances, but how it accomplishes this we do not know. Judd[16] says, "It has long been suspected that among other known functions, ... the liver possesses a detoxifying property intended to protect the body against bacterial invasion, against the toxic products of bacteria, against metabolic poisons, and against a great variety of foreign substances inimical to the organism. It is the opinion of all who have investigated the question, that in the great majority of chronic infective abdominal conditions, certain inflammatory changes follow in the liver which have been called by the somewhat vague term "chronic hepatitis . . . The hepatic lesions in these cases appear to us to represent, not a single embolic infection of the organ, but rather a series of minute insults occurring over a long period as they are found in various stages of development throughout the substance of the liver." Gutzeit and Wendt[17] found that gastrointestinal abnormality long antedated the condition of the liver and spleen. Brown proved

that cholecystitis did not occur unless actual inflammatory lesions were present in the liver. Back of that he says are concomitant lesions in the intestinal tract or more remotely in the portal system. Rehfus states that it is a notorious fact that in almost all gallbladder diseases there are associated intestinal disturbances almost always of the stasis type, — that any method of biliary treatment which fails to regulate the bowel cannot be successful. Mannheim,[18] Royster,[19] and others support this sequence of infection.

Lymphatic Drainage

The only other important factor in the second line of defense is the mesenteric lymphatic system. Herring and MacNaughton have shown that the lymphatics are concerned with the absorption of solids and material insoluble in water, while the blood capillaries are mainly associated with the absorption of material which is soluble in water. W. J. Mayo[20] states that postmortems show that half the patients who die from cancer of the colon have no cancerous involvement of the lymphatics at the time of death, although the glands may be greatly enlarged from sepsis. Braithwaite[21] has carefully traced the lymphatic drainage from the right iliac fossa, demonstrating that the normal drainage from the ileocecal angle followed a chain of glands along branches of the superior mesenteric artery to the lumbar group of nodes lying just above and behind the third portion of the duodenum and then directly into the receptaculum chyli. Further evidence brought to bear on this subject by many independent workers leads one to the conclusion that the large group of glands lying on or near the head of the pancreas with the group on the superior mesenteric trunk act normally as one big receiving station, with extensive backward and forward communications, allowing lymph, hindered in its flow in one direction, to pass in another. Following this line of reasoning, Braithwaite,[21] Wilkie,[22] Moynihan,[23] Mayo, Murphy, Deaver,[24] and others have admitted the possible causal relationship between infections in the region of the cecum and inflammatory processes in the neighborhood of the duodenum, including gastric and duodenal ulcer, gallbladder disease and duodenal stasis. Thus we see vast possibilities of development of secondary foci of infection as well as general systemic infection resulting from inefficiency or overwhelming of this system.

Regeneration of the Liver

The ability of the liver to regenerate after injury or loss of tissue is well known. This of course is a special provision of nature necessitated by the vital importance of this organ. Nevertheless, continuous minute injury to liver cells operating over a long period of time produces damage not easily repaired. As Snell[25] says: "It is also recognized that previous hepatic injury leaves the liver with a variable amount of regenerated hepatic tissue which has been shown to be unusually susceptible to injury. Successive degenerative lesions of the hepatic parenchyma are more and more easily produced, and each in turn interferes further with the hepatic blood supply." True hepatic cirrhosis represents the end result of a process of repair and progressive fibrosis consequent on successive focal degeneration or necrosis of the hepatic cells at the periphery of the lobules. Snell[25] further remarks: "The reparative processes eventually restrict the portal, venous and capillary bed, and the anatomic end-result is disorganization of hepatic structure with lobulation and formation of adenomas. The physiologic end-results are two: portal hypertension and hepatic insufficiency. Opie has suggested a combination of bacterial infection and chemical intoxication."

With portal hypertension we have a backing up of the venous blood into the capillary beds of the mesenteric and other arterial systems supplying the

portal circulation. But as the arterial pressure is greater than the portal there can never be a reversal of the current. The only venous anastamosis of clinical importance exists between the middle and superior hemorrhoidal veins which normally empty into the portal circulation and the inferior hemorrhoidal veins which flow into the iliac veins. Portal pressure being greater than the iliac, there will be a reversal of flow in the superior and middle hemorrhoidals which will now drain through the inferior hemorrhoidals into the general circulation. Much of the portal blood will follow this route carrying with it unaltered toxic substances from the intestinal tract. The presence of internal hemorrhoids, proctitis, perirectal abscesses are common sequellae. Charles Mayo has placed special stress upon this sequence.

Intestinal Toxemia

With general breakdown of the second line of defense a symptom complex, chronic intestinal toxemia, commonly develops. This syndrome is not a well defined entity, but presents variable pictures in different individuals. The responsible factors are individual susceptibilities of tissues and organs, and variations in the third line of defense, which embraces immunity, detoxication, allergy and elimination. In the past there has been considerable controversy over the symptomatology of colonic origin. Those[26] who claim there is no such condition as chronic intestinal toxemia would classify all symptoms as nervous reflex, from a distended rectum or spastic colon. Symptoms in this category may or may not be present in chronic intestinal toxemia. They are not pathognomonic. There is however, a group of findings not so easily disposed of, which though not pathognomonic may be checked in many ways as being of intestinal origin. These include: anemia, high or low blood pressure, abnormal blood sedimentation rate, abnormal urinary findings, pasty skin, mental and physical exhaustion, loss of weight, tendency to taking colds, catarrhal conditions of various mucous membranes, and the like. Combe,[13] Bassler,[27] Redewill,[28] Sexton,[29] myself[30, 31] and others have discussed them rather thoroughly and referred to the literature on the subject.

Uncorrected, this syndrome leads to arteriosclerosis, chronic secondary anemia, arthritis, nephritis, myocarditis, endocrine and sympathetic exhaustion, neuritis, colitis, and cirrhosis of the liver. Specific toxins have never been isolated from the blood. Toxins of intestinal origin must run the gauntlet of the three capillary circulations of the liver, lungs and the periphery, before reaching a vein from which blood may be withdrawn for examination. By that time they have become altered, mingled with toxins from other foci of infection, and are largely eliminated as gases and nontoxic conjugated end products. As chronic focal infection may be either cause or effect of chronic intestinal toxemia it is very difficult to discuss either condition apart from the other. They almost invariably coexist and their symptomatology is much the same. The liver is always involved in both, and as the common factor in all vicious circles of infection may be considered the unifying agent in every chronic systemic infection.

Inadequacy of Therapy

The systems and methods of therapy at present in use for this syndrome are manifestly inadequate and unsatisfactory. Most of the systems have been limited to the special fields of endeavor of the individuals developing them and have therefore become highly specialized. Bassler[32] says of his method: "Unless all of the work is done by one person, and not entered into practically until several years of experience have been acquired, I strongly recommend that it be not engaged in at all." Lane, Kellog, Lyon, Rowe, Kantor, Metchnikoff and others have been inspired to study certain phases of this complex problem. So

far, however, no one has succeeded in combining all information into a single unified system of therapy. Rehfus[6] says of colon bacillus infection of the biliary tract, "The failure to develop a satisfactory means of therapy to combat this condition is one which has prevented us from controlling what we believe to be a very common condition." The use of yeast, implants of bulgaricus, acidophilus and colon bacilli, intestinal antiseptics, cathartics, medication and diet have all proved disappointing. Bockus[33] says, "The management of these patients by the rank and file of physicians is not particularly flattering to the profession." It is obvious that the very specialty whose task it should be to render this service, has failed signally.

The reasons for failures of the gastroenterologist are involved, yet understandable. He has endeavored to study the subject accurately and scientifically, and to apply specific treatment. He ascertains the exact nature of the toxins involved, where and how formed, and the microörganisms assuming the pathogenic rôle. He studies the stomach contents, feces, blood, urine and roentgenograms of the gastrointestinal tract. Then there must be exact remedies applied, — specific vaccines, a carefully planned dietetic régime, medication, etc. This is all very good and in principle above criticism, but for the average physician it is too complicated and technical. The patient's chief interest is in getting well as quickly and as reasonably as possible. Therapy could be more successful and the patient better served if the physician would sacrifice a little of his desire for accurate but nonessential information and give his patient the benefit of tried and proved measures, even though they may appear empiric and nonspecific. With his diagnosis reasonably certain, he should apply the broad principles of drainage, improvement of general resistance, rest and nutrition. Nature is able to care for the details of specificity in this syndrome much better than he.

Other specialties are demanding a more simplified, rational therapy for chronic low grade infection. Ophthalmologists, dermatologists, urologists, surgeons, orthopedists, physical therapists and others thoroughly realize the importance of focal infection as a cause of disease. Yet Rehfus[6] says: "There are apparently no culture methods for determining colon pathogenicity." Snyder[34] says: "In regard to the importance of bacterial examination of the stool I must admit that I am not an enthusiast." Soper[35] "I do not rely upon vaccines." Sexton:[36] "I quite agree that our laboratories know very little about the bacteriology of the colon." Lieb[37] "The present tendency in fecal work is away from the specific identification of these types. There is a wide divergence of opinion as to what constitutes a normal intestinal flora." Laus:[38] "Bacteriology of the stool is so complicated that it is rarely accurately done, clinically." On the other hand Snyder[39] maintains: "Colonic therapy is becoming an increasingly employed method in the management of arthritis, and rightly so, for there is no doubt that, in a great number of cases, this mode of treatment is highly successful." Burbank[3] states: "Properly given colon irrigations are the most satisfactory means we have of freeing this area from toxic substances." Fishbaugh[40] says: "Thorough bowel irrigation by means of the cecal tube has been of inestimable value in relieving a number of cases who were not influenced by the dietetic and laxative measures." Lautman[41] avers: "In recent years more and more importance is being attached to the colon bacillus as a possible factor in the production of arthritis and the part which the intestinal tract plays as a focus of infection is becoming more frequently stressed." Similar quotations could be given from many others, including Traut, Gutman, Marshall, Cotton, Goldfain, Worster and Bastedo.

Colon Therapy

That the colon should occupy a position of such great importance in the therapeutic approach to this syndrome is perhaps accidental; yet we know that

once it is involved, whether primarily or not, the cure of this condition is hopeless until it is eliminated as a factor. Strategically it holds first place. It is the important link in the wholly visceral vicious circle, and yet, theoretically, infection in it exists outside the body. Other foci may be surgically removed or drained, or successfully treated chemically or biologically, but not the colon. Infection in it is very difficult to influence, as evidenced by many elaborate attempts. For these reasons colonic lavage and instillations for the purpose of tubular and cellular drainage, the evacuation of old infected residues from the proximal colon, the healing of inflamed and injured tissues, the restoration of normal mechanical and cellular function, improvement of the lymphatic and capillary circulation of the entire tract, relief to the liver from its increased toxic load and remotely to every tissue of the body, are the most logical and actually successful procedures at our command with which to inaugurate attack on this syndrome. We are using the method of most direct approach to the key focus of infection.

Intestinal toxemia however is just one manifestation of a low grade chronic infection involving the whole organism and dependent upon many factors, all of which must be taken into consideration in any comprehensive program of therapy and management. The continued presence of primary foci is neither a necessary nor sufficient cause of chronicity. Factors influencing chronicity are deficient immunity, allergy, poor mechanical drainage of an organ or tissue from any cause, spasticity, and the existence of vicious circles. There are also psychic, neurogenic and endocrine factors, both hereditary and acquired. We must therefore include in our therapy all measures necessary to correct all factors either predisposing to or tending toward the continuance of this syndrome. These may include surgery, diathermy and other forms of physical therapy, psychotherapy, vaccines, tonics, adequate rest and nutrition.

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SIMPLIFICATION OF RADIUM TECHNIC IN UTERINE CERVICAL CANCER *

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The technic of radium application in uterine cervical cancer can be simplified and better results secured by heavily filtered radium from multiple centers in accordance with the principles of the Radium Institute of the University of Paris (Regaud technic).

Principles

The principles underlying the Paris (Regaud) technic are:

1. Proper preliminary treatment. This entails the administration of antiseptic douches for a number of days preceding the actual radium treatment for the purpose of clearing up the associated local infection invariably present in uterine cancer.
2. The application of comparatively small amounts of radium over a prolonged period to increase the biologic action of the rays, and of the greatest possible dosage without injury to the surrounding normal tissues. (Sixty to seventy milligrams for five or six days, the dosage rarely exceeding 8,000 milligram-hours.)
3. Employment of multiple radium centers distributed throughout the entire uterine canal and the vagina. (Three in the uterus and three in the vaginal vault for the average patient.)
4. The use of heavy filtration (1.0 to 1.5 millimeters of platinum or its equivalent), permitting only the deep penetrating gamma rays of radium to be emitted and thereby avoiding necrosis of the tissues.
5. The use of external radiation, in addition to the intra-uterovaginal radium therapy, when the growth has extended beyond the uterus.

The principal question, then, is how can multiple centers of heavily filtered radium be most easily applied in cervical cancer?

The first requisite after an accurate diagnosis has been made, is to determine the potency of the cervix and the length of the uterine canal. The size of the vaginal vault, too, should be established. The technic necessitates that the entire length of the uterine canal be radiated and that multiple centers of radium be placed in the vaginal vault. The plan is to place one center of radium for each 2 to 2.5 cm. length of the uterine canal (average canal 6 to 7.5 cm., hence three radium centers). If the vaginal vault is normal in size, three radium centers are placed there.

In 1928 the author devised an adjustable "T" shaped uterine radium applicator that has helped to simplify the Paris technic. The stem of this applicator can be assembled to accommodate any length of the uterine canal (from 1.5 to 10 cm.) so that from one to five radium centers can be placed in this part of the applicator. The vaginal cross-arm part of the applicator is made to receive one or two radium centers; that is, it is provided with either a single barreled cross-arm vaginal or a double-barreled head. Using this applicator to treat an average patient a total of four radium centers are utilized — three in the uterine

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 9, 1935.

* By special arrangement this article also appears in the March, 1936 issue of the *Radiologic Review and Mississippi Valley Medical Journal.*

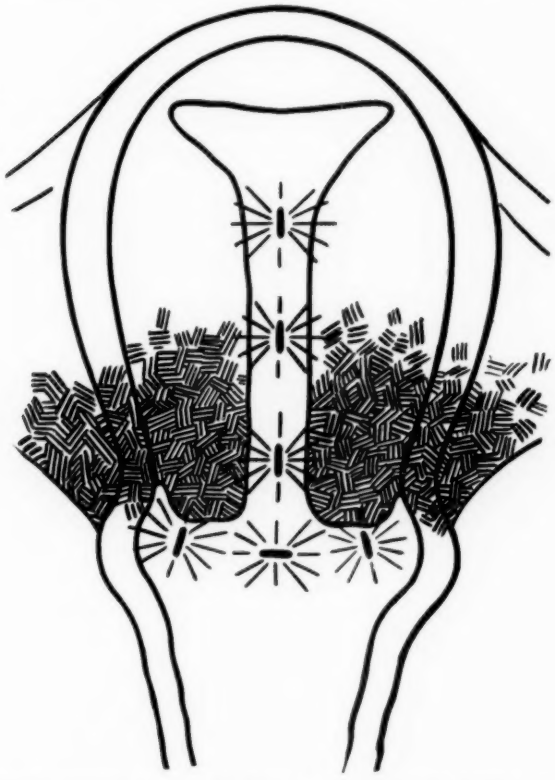

Fig. 1. — A schematic drawing showing an early Stage III uterine cervical cancer, the type most commonly present when the patient presents herself for treatment. The position of the radium centers in accordance with the Paris (Regaud) technic, is shown in the uterine canal and vaginal vault, thus radiating the entire uterus, cross-firing on the cervix and sending radiation into the parametria.

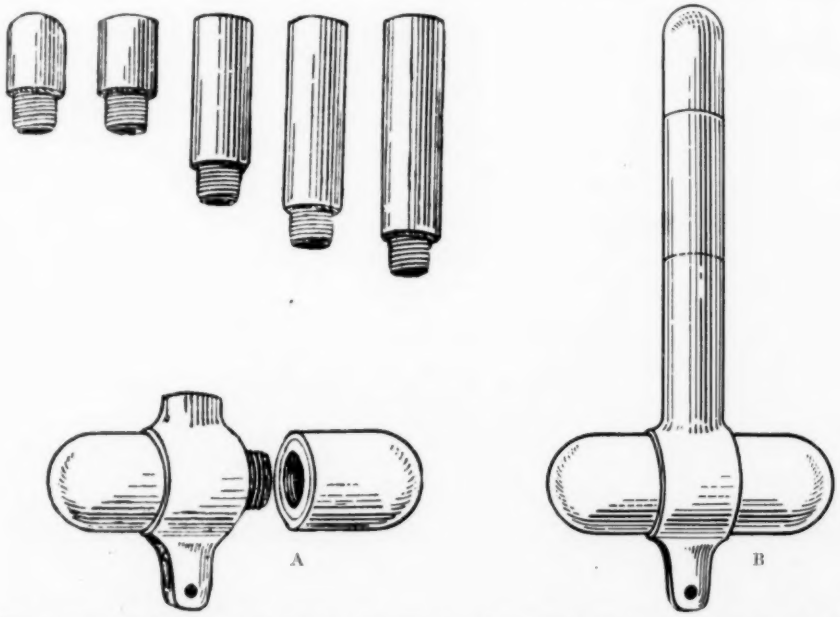

Fig. 2. — a. Individual parts of the author's "T" shaped adjustable uterine radium applicator (with single barreled vaginal cross-arm piece). b. Applicator shown assembled for use in a uterus of average length (actual size). As a rule three radium centers are placed in the uterine stem and one in the vaginal cross-arm piece in treating uterine cervical cancer.

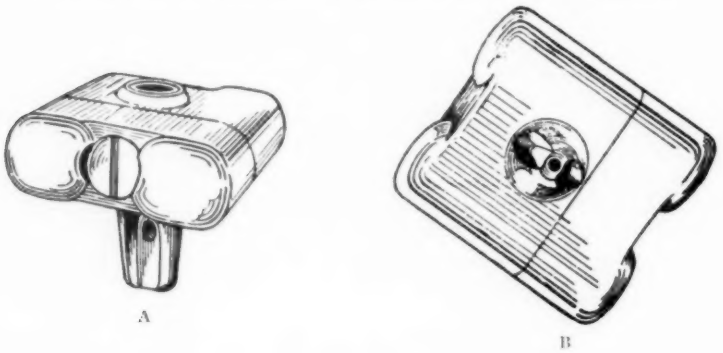

Fig. 3. — a. Side view. b. End view of the double barreled vaginal head of the author's adjustable uterine radium applicator (actual size). This provides two vaginal centers for radium.

stem to treat the entire length of the canal and one in the vaginal cross-arm piece to radiate the vaginal part of the cervix. The average case will, therefore, require two more centers of radium placed in the vagina, one in each lateral vaginal fornix. This can be accomplished by the insertion of a colpostat as used at the University of Paris. The colpostat is a double barreled applicator, each barrel being placed in a lateral vaginal fornix and held together with a rubber covered spring. Frequently, however, the colpostat is difficult to be correctly applied and impossible of insertion if the vaginal vault is small.

Advantages of London Vaginal Applicator

For the past year I have made use of cylindrical bakelite applicators with handles attached, instead of a colpostat, for the purpose of placing radium to the vaginal fornices. This is the type employed at the Radium Institute of London, which possesses the following advantages: (a) The ends are so rounded that the applicators can be comfortably placed and the pressure on the vaginal mucous membrane evenly distributed. (b) The wall thickness of the bakelite is sufficient to form a secondary screen which permits of a large radium dosage within the limits of tissue tolerance. (c) As many applicators can be used as the anatomical size of the part will permit. (d) The applicators can be inserted with ease and correctly placed by means of holders. (e) By retaining the applicators in accurate position while the vaginal pack is placed, they are certain so to remain during the treatment.

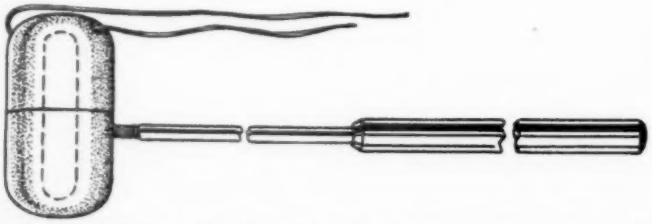

Fig. 4. — The Radium Institute of London vaginal bakelite, radium applicator, together with handle for introduction (actual size).

The combination of the "T" shaped adjustable uterine applicator with the London cylindrical vaginal capsules makes an ideal method for treating uterine cervical cancer. Any length uterine canal can be radiated and if the canal is much angulated an angle wedge can be placed in the uterine stem of the applicator proper. If the vaginal vault is extremely small the simple "T" shaped uterine applicator providing one vaginal center will prove sufficient. If the vault is a trifle larger, the double barreled vaginal "T" shaped uterine applicator

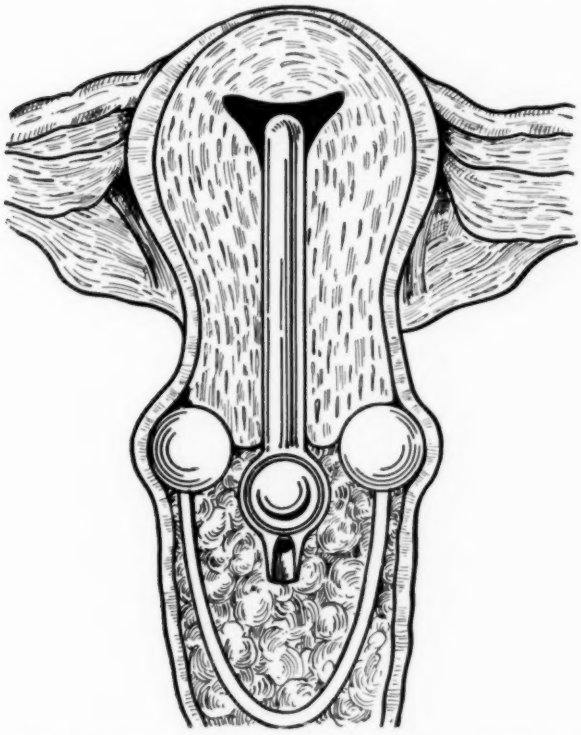

Fig. 5. — The author's adjustable uterine radium applicator and a vaginal colpostat applicator as they appear when correctly placed for treating uterine cervical cancer in the average case. By this means, six radium centers are provided in the average case — three in the uterine canal and three in the vaginal vault, thus carrying out the principles of the Paris (Regaud) technic.

is ideal. If the vault is normal in size the simple "T" shaped uterine applicator plus the introduction of two of the London vaginal capsule applicators represent an ideal combination. However, if the vault is of large size the double barreled vaginal "T" shaped uterine applicator, together with two of the London applicators are best. Another possibility of radium technic is to take the cross-arm piece off the uterine applicator, using only the uterine stem and as many of the London vaginal applicators as the size of the vault will permit.

We place 10 or 12.5 milligrams of radium element in each radium center (filtration equivalent to 1 to 1.5 mm. of platinum) and give a 4 to 5-day treatment. Six centers, totaling 75 milligrams are used for 100 hours (7500 milligram-hours) for an average case. This radium treatment is supplemented with a series of high voltage (200,000 volts) x-ray treatments given through multiple portals in all but the stage I types. This is preferably given before the radium treatment and while the patient is receiving daily hot antiseptic douches in an effort to control the invariably present secondary infection.

Statistics of the University of Paris

Some idea of the results obtained by this technic of radiotherapy can be had from the following statistics from the University of Paris, recently sent by Professor Claud Regaud (associate of the late Mme. Curie) in a personal communication to the author. These represent the 1925-1929 patients — the most recent for which five-year studies are available. All these cases were microscopically confirmed cervical cancers treated by radiotherapy alone. All patients who died of intercurrent disease or of whom record was lost during the five-year period, were considered radiologic failures (table 1).

TABLE 1. — *Statistical End Results of Radiotherapy (Regaud Technic) from The Radium Institute of Paris, 1925-1929*

	Patients Treated	Percentage Each Stage	Cured End 5 Years	Percentage 5-Yr. Cures
Stage 1*	37	8%	28	75.6%
Stage 2	169	37%	72	42.6%
Stage 3	201	43%	64	31.8%
Stage 4	57	12%	1	1.7%
Total	464	100%	165	Av. 35.6%

* The Stage of the disease, for statistical purposes, was established by the rules laid down by the Section of Hygiene of the League of Nations.

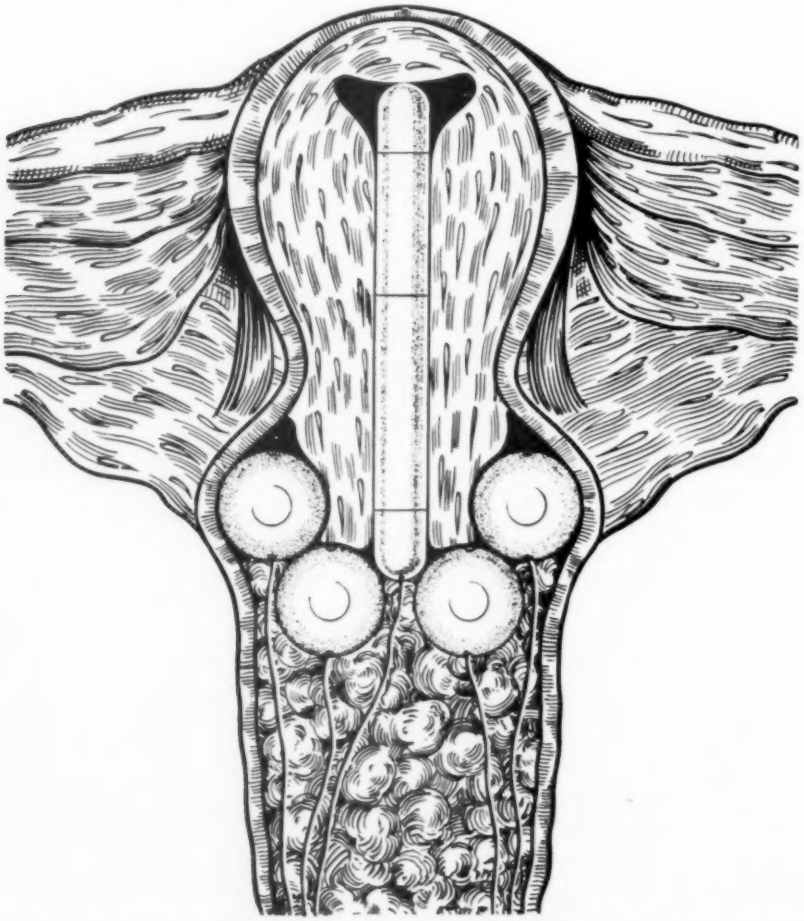

Fig. 6. — The author's adjustable uterine applicator without vaginal cross-arm piece, occupying the entire length of the uterine canal and four of the London vaginal radium applicators which occupy a large-sized vaginal vault. Used in treating uterine cervical cancer in accordance with the principles of the Paris (Regaud) technic.

Summary

The results of the five-year study shown above (464 cases with 35.6 per cent curability) are the most favorable as yet reported from a large research institute. They are based on carefully kept records and persistent follow-up examinations. The results secured are the best possible proof of the efficiency of this method (Paris Technic) of radiotherapy.

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(*Concluded on page 180*)

FEVER THERAPY IN DEMENTIA PARALYTICA *

Its Status at State Hospitals of Illinois

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Of the many hospitals in Illinois those located nearest to Chicago have made the most progress in fever therapy, through contact with our four great medical schools and the large number of medical societies. The most intensive work has been initiated by the State Psychiatric Institute which was recently transferred from Elgin to Chicago, and is at the present time an integral part of the University of Illinois College of Medicine, and the State Department of Public Welfare.

Many of our state hospital executives and physicians have had a great deal of experience with malaria therapy and still feel that this is the method of choice. I have long been of the opinion that the dangers of malarial fever produced in patients who are already suffering from a serious disease are numerous. In this connection it may be of interest that at the last annual meeting of the Illinois State Medical Society held in Rockford, May, 1935, Dr. H. J. Shaughnessy of Springfield, read a paper entitled "Artificially-induced Malaria as a Public Health Hazard." An abstract of his paper is as follows:

An unusual number of positive laboratory tests for malaria directed the attention of the Illinois department of Public Health to the cause of an apparent outbreak of that disease in one of the state hospitals. Investigation revealed that a number of previously inoculated paretics who had been treated with quinine were still harboring malaria parasites. Anopheles mosquitoes were found breeding within flying distance of the hospital. The conclusion is drawn that the outbreak was possibly due to the spread of artificially-induced malaria by mosquitoes. Measures for the prevention of this possibility are suggested.

Therapy by Electropyrexia

It was with considerable difficulty that we have tried to introduce newer methods of treatment combined under the heading of Electropyrexia. At the Kankakee State Hospital intensive studies have been carried on in the combined treatment of this disease by means of typhoid vaccine and the Electric Cabinet, and the physicians there have kindly consented to permit the following report of their experiences. Drs. Hoverson, Morrow and Hawthorne reported in the Illinois Medical Journal for March, 1933, and also further reported to me by personal communication. They proceed as follows:

The cabinet was fabricated and constructed in the sheet-metal department of the hospital at a cost of about $35. The cabinet is constructed of 24-gauge galvanized iron. The center inside height is 24 inches, and the sides are vertical for a height of 14 inches, and then curved gradually to the center. One end of the cabinet is closed by a galvanized iron section "double-sealed" to the main body of the cabinet. Wires insulated by asbestos are placed in the grooved ribs and lead to electric sockets which are located on the sides of each rib. Four such sockets are on each side of the rib, giving a total of eight lights per rib and a total of 24 lights. The lights are placed in a series of twelve lights each, which permits the use of a greater amount of heat in producing the desired temperature, and of a lesser amount of heat, to maintain a given temperature with

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 9, 1935.

comfort to the patient. The current used is a 220-volt D. C. The bulbs are each of 30 watts and are shielded by a heavy wire netting attached to the frame and wooden rib. The lights are controlled by two switches on the outside of the cabinet, one for each series of lights. The bed is prepared by first placing a rubber sheet on the mattress, and over this is laid a cotton sheet. The patient is unclothed and covered with a cotton sheet which is placed on the bed. The cabinet is put in position over him and a blanket is draped over the open end around his neck. Then several thicknesses of woolen blankets are laid over the cabinet. The 24 lights are turned on and remain burning until the patient's temperature has reached 104 degrees F. Then only twelve lights are used until a temperature of 105 degrees F. has been reached. All the lights are then turned off. A temperature of 103.5 is usually obtained in two hours, and the temperature usually rises to 106 degrees F. and remains at this level for about one hour. When the temperature begins to drop from 104.5, twelve lights are turned on and kept on until the temperature again starts to rise. Their procedure has been to keep the temperature over 105 and under 106 degrees — for three to five hours. At first the patients were placed unclothed in the cabinet, without a sheet between them and the lights. In these cases a loss of weight of five pounds is not uncommon. When a sheet was placed over the patient, the usual loss of weight was about one pound. This loss was regained the following day. In all cases the patients were urged to drink water. Sometimes as much as six liters were consumed, the average being about three liters.

The personal communication from these physicians on their results is as follows:

Up to the present time, there have been a total of 47 patients treated by this method. No one of the 47 has received more than 30 nor less than 12 treatments, and all courses of fever therapy have been followed by a series of ten tryparsamide injections. The number of fever treatments is determined by the patient's response. When it is believed that the patient has shown the maximum improvement, fever therapy is discontinued, if 12 or more treatments have been given, and tryparsamide injections started. All patients who are considered improved sufficiently to warrant their release, are presented before the entire medical staff, and their release considered. The release of a patient is based upon the opinion of the entire medical staff. Of the total of 47 patients, one died in the course of the disease. Fourteen have been discharged from the institution as recovered, and an additional four are now awaiting arrangements on the outside for their release. Accordingly eighteen of the 47 have been recommended for discharge by the medical staff. No patient who has been represented has been found not fit for discharge. Of the remaining 28 patients, 11 have shown marked improvement and apparently are able to be discharged. They will be considered for release as soon as they have completed their courses of tryparsamide. It is seen that 29 patients have shown marked improvement, one has died, and 17 have shown little or no improvement.

At the Manteno State Hospital, which has recently been opened, and which will ultimately accommodate 10,000 patients, no fever therapy has as yet been instituted.

The hospitals in the southern part of the state have been depending for the most part on malaria therapy with the usual partially satisfactory results. These hospitals include those at Alton, Anna, and Jacksonville.

At the eleventh annual session of this congress held in New York City in 1932, I reported on a series of 500 patients who were treated by various forms of fever therapy at the Elgin State Hospital and the Illinois State Psychopathic Institute, during the period 1927-1932. In this study I have not included those patients who died soon after treatment, (a very few), or those who were not physically able to complete a course of fever treatment.

The serology soon after treatments showed the following results: The Wassermann and Kahn tests on the blood and spinal fluid showed an improvement in only 4 per cent of the cases. The cell counts in the spinal fluid often showed marked improvement. In 22 per cent of the patients a high cell count was reduced to normal at the end of the treatments. In all patients in whom globulin was present before treatment it persisted afterward, but there was always marked reduction in the degree of positiveness.

A marked improvement was noted in the colloidal gold test, the paretic curve frequently changing to the ordinary luetic curve. The results were as follows:

TABLE 1. — *Evaluation of Electropyrexia in 500 Patients*

Form of Therapy		Improved	Unimproved	Worse
Typhoid Vaccine	100 patients	52%	28%	20%
Sulphur-In-Oil	100 patients	58%	21%	21%
Malaria	100 patients	66%	20%	14%
Diathermy	100 patients	72%	11%	17%
Electric Blanket	100 patients	78%	15%	7%

The Electric Blanket

The electric blanket has been in use at the Elgin State Hospital and the Illinois State Psychopathic Institute for the past five years, and we feel that it is the simplest and safest form of fever-producing agents. We think that the most acceptable theory of the mechanism of this form of treatment is that the fever brings about first, some change in the spirochaetae and secondly, organically, in the endothelial system of the host. The blanket is about six feet square and by a connecting cord is simply plugged into an electric socket in the wall. The patient is wrapped in blankets, and covered by the electrically-heated blanket. The wires of this device have enough tensile strength to resist breakage for many months; they are vulcanized into pure gum rubber and the temperature of the instrument can be controlled by a rheostat. The wires are of copper alloy size 36, stranded 28 to the cable, with double cotton insulation spaced 1/3 inch apart and woven into the fabric so that no two wires can produce short circuits.

In treating patients, use is made of an ordinary alternating current, which is introduced for one hour, stopped for ten minutes for each hour of use, then turned on again. The temperature rises to 103.6 degrees F. in one and one-half hours; then the current is shut off and the temperature of the patient rises to 105 in 15 minutes, then to 105.6 in another 15 minutes. The blanket is now removed and the temperature of the patient remains at 105 for an hour and a half, after which it returns to normal in about two hours. After a cold sponge and a little sleep the patient is ready to go about his business with no ill effects. Approximately 75 per cent of the patients under this treatment have shown some degree of improvement, and about one-third have developed such well-marked remissions that they are classed among the best workers in the institution. Some of the improvements have been startling; as, for instance, the case of a bed-ridden individual, apparently deeply demented, who, on the completion of these treatments, had so far improved that he became a good worker and had parole for the grounds. The practical question of how many have been improved to the extent of ability to return home and to renew their occupation is as yet unsettled because of the industrial depression.

Evaluation of Remissions

The survey of those in remission serves to make us expect an ultimate discharge rate of about the same as that of von Jauregg, namely, 20 per cent. If our experience follows that of his, these 20 per cent of patients will not have to re-enter an institution. Perhaps in time we can do better than this, but it is believed that it will come about only when the general practitioners and the public at large learn the importance of starting this form of treatment before mental deterioration has set in. About 80 per cent of our patients seem to come to us only after brain-cell destruction has progressed

to such a serious degree that even though the disease be checked, their re-socialization is impossible. There are no dangers connected with this form of treatment, and we reject only those patients who are in an advanced stage of physical or mental deterioration.

A survey was recently made at the State Psychopathic Institute and the Elgin State Hospital of 300 patients treated with the electric blanket over a five-year period, 1930-35. During the treatments each patient lost about five pounds in weight, but the loss was generally made up by the time of the next treatment. Following the weights throughout we found that 45 per cent of the patients gained, 31 per cent remained stationary, and 24 per cent lost slightly.

Neuro-serologic Findings

Regarding the neurological changes, speech was improved in 18, and the gait in 8 per cent. There was little alteration in the other neurological signs; the ocular findings and reflexes remaining unchanged.

The mental symptoms improved in all of the discharged and improved patients, and became worse in those who were gradually deteriorating in spite of the treatments; the latter group constituted 7 per cent of the total.

The serological findings are as follows: Wassermann and Kahn tests on the blood were reduced in strength in only six patients of the 300. The Wassermann and Kahn tests on the spinal fluid remained the same in all of the cases. The cell counts in the spinal fluid often showed marked improvement almost at once in 86 per cent. In 26 per cent of the patients a high cell count was reduced to normal at the end of the treatments. In all cases in which globulin was present before treatment, it persisted, but there was marked reduction in the degree of positiveness in 72 per cent. A marked improvement was noted in the colloidal gold test, the paretic curve changing to the luetic curve in 32 per cent, and flattening down in 26 per cent. Regarding the permeability quotient, there were 71 per cent who had increased permeability for the bromides before the treatments. This permeability decreased, i. e., returned toward normal in 83 per cent of the patients who showed clinical improvement.

Of the 300 patients treated, 72 per cent were definitely improved, 10 per cent remained stationary, 7 per cent deteriorated, and 11 per cent died. Of the improved patients, 30 per cent were discharged by the Elgin State Hospital, and 14 per cent are now on parole.

Methods of Treatment

The following methods of treatment were used at the Elgin State Hospital during 1934:

TABLE 2. — *Methods of Fever Treatment Employed at Elgin State Hospital*

Form of Therapy		Improved	Unimproved	Relapsed	Died
Malaria	96 patients	68%	16%	4%	12%
Electric Blanket	40 patients	60%	28%	12%	0%
Sulphur-In-Oil	60 patients	35%	55%	0%	10%
Typhoid Vaccine	27 patients	74%	26%	0%	0%
Combined Forms	24 patients	46%	42%	4%	8%
Total	247 patients	58%	30%	4%	8%

In studying the above figures we are impressed by the high mortality rate among those patients treated by means of malaria, namely, 12 per cent, which is higher than that in any other form of treatment. In this connection I desire to call attention to the following: At the Fifth Annual Fever

Conference held in Dayton, Ohio, May 2nd and 3rd, 1935, Dr. A. E. Bennett, of the University of Nebraska, in discussing the paper of Drs. Ebaugh, Barnacle and Ewalt of the University of Colorado School of Medicine, said: "I am not certain that I understood correctly, but it seemed to me they stated that the malaria mortality was around 24 per cent for the group of advanced paretics and cerebral syphilis; and 11 per cent of those died within a year after malaria. This is the big thing that has made me feel that malaria is on its way out so far as fever therpy is concerned. It certainly carries a mortality in anybody's hands."

TABLE 3. — *Results of Fever Treatment in Paretics Admitted and Treated at Elgin State Hospital in 1934*

Form of Therapy	No. Treated	Improved	Unimproved	Relapsed	Died
Malaria	96	67	15	3	11
		68%	16%	4%	12%
Electric Blanket	40	24	11	5	0
		60%	28%	12%	
Sulphur-In-Oil	60	21	33	0	6
		35%	55%		10%
Typhoid Vaccine	27	20	7	0	0
		74%	26%		
Combined Forms	24	11	10	1	2
		46%	42%	4%	8%
Totals	247	143	76	9	19
		58%	30%	4%	8%

Conclusion

Interest in hyperpyrexia has been greatly stimulated by the work in many clinics, and all methods seem to have shown various degrees of improvement. We hope that education of the laity and the medical profession will lead to earlier treatment, and that further research work along treatment lines by investigators will produce even more favorable results in patients afflicted with dementia paralytica.

In producing remissions and possible cures in many patients who were formerly given up as hopeless, we have effected a tremendous saving for the taxpayers of the State of Illinois, in addition to ameliorating the ravages of this dread disease.*

55 East Washington Street.

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* I wish to thank the physicians, nurses, and other members of our Illinois state institution for their many hours of work in helping to prepare this survey.

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Discussion

Dr. F. H. Krusen (Rochester, Minn.): Dr. Kuhns bears out the encouraging results by physical means that have been seen elsewhere in the treatment of dementia paralytica. The technic, particularly in the use of the electric blanket, has proved in his hands very satisfactory and bears out a point I made in the instruction course last week that it matters little what type of physical agent is employed so long as the technic of the individuals who are giving the treatment is good.

His percentages are even better than those given for the malarial method of treating dementia paralytica.

Dr. E. Goldfain (Oklahoma City, Okla.): I would like to know if Dr. Kuhns has any figures on the death rate with typhoid injections.

Dr. Florence A. Stone (Waukegan, Ill.): In the treatment of these cases, with the positive Wassermann or Kahn, did I understand Dr. Kuhns to say there wasn't any change in the blood picture? I have had one case of inherited syphilis, typical of Hutchinson's disease, with osteomyelitis of the tibia for the past three years. I have used neoarsphenamin and bismuth injections, but cannot get a negative Wassermann or Kahn blood reaction.

Dr. Ralph H. Kuhns (closing): I was hoping Dr. Krusen would go into the therapy a little more fully, because he had a good deal of experience both in Philadelphia, and now at the Mayo Clinic, and I thought he might say something about the new cabinet which has been developed at Dayton, and also other air-conditioned cabinets for producing fever. If he had mentioned that, I would have said we have had no experience with those cabinets in Illinois. I am hoping we can get money enough to try them.

In regard to the question on the typhoid vaccine death rate, at the New York meeting in 1932, I reported on 100 patients treated by typhoid vaccine, where the improvement was 52 per cent, the unimproved patients 28 per cent, and 20 per cent were worse. At Kankakee, they had only one death in 47 patients treated by typhoid vaccine. The death rate last year at the Elgin State Hospital in 27 patients treated with typhoid vaccine, was zero.

I think the death rate is rather low, but our physical means are much superior to typhoid vaccine. I think almost the same can be said as regards malaria. While we are not introducing a new disease, still we are utilizing killed bacteria, and I am in favor of physical methods rather than producing a disease or even resorting to vaccine therapy.

Answering Dr. Stone, reports at the Dayton meeting last May of the Conference on Fever Therapy were much better than ours regarding the change in the blood Wassermann and Kahn, and also the spinal fluid Wassermann and Kahn reactions. We have noted very few changes in the blood Wassermann and Kahn. Only six out of our 300 had a change in the blood Wassermann, and none in the spinal fluid, although I know the reports in the East are much more favorable. At the New York State Psychiatric Institute and at the Boston Psychopathic Hospital they have changed the blood picture in many more patients than we have been able to accomplish.

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EDITORIALS

DIATHERMY IN PNEUMONIA

At this season of the year and in all temperate countries, the physician is once again hopefully but grimly laboring to avert the many expectant tragedies due to pneumococcic infections. In spite of the recognition of pneumonia as a disease, the intensive study of its causative nature, and the remedial agents introduced for its control and eradication, the medical profession faces the situation of stemming the progress of what Osler picturesquely called the "Captain of the Men of Death" with little more optimism than that of the preceding generation. In 1930, nearly one hundred thousand deaths were reported in the United States as due to some form of pneumonia. Since statistical records indicate that the mortality rate is about 25 per cent it would appear that approximately four hundred thousand cases of pneumonia occur every year in the United States alone, without even considering the large morbidity percentage left in its wake. Today in spite of greater knowledge of every phase of this important problem our therapeutic efforts have been largely routinized toward hygienic measures, relief of symptoms by medicinal and physical agents, and specific serum.

It is a peculiar phenomenon with the medical as well as with other professions that once a worker has by his labors achieved recognition as an authority, any of his dicta are regarded almost as a slogan applicable to any related situations without special considerations. In the problem of pneumonia nothing has tended to develop a therapeutic nihilism more than the late Osler's teaching that pneumonia is a self limited disease. Unfortunately, the bulk of the medical profession has not appreciated the occult irony contained in the master's dictum, for in his as in our time the limitation of pneumonia has only too often taken the form of a lethal termination.

One needs only consult even our best and most recent textbooks on internal medicine to become convinced of the result of an unconditional acceptance of

dogma, for one will fail in obtaining any therapeutic advice beyond the hygienic management and symptomatic medication. With the exception of the recently developed serum, which unfortunately is useful in only the so-called Type I of pneumonia, medicinal therapy records no progress. While this situation is perhaps a hangover of past teaching, our authorities cannot be freed from the charge of failure to take cognizance of the effectiveness of one physical agent which clinical experience has shown to come to possess almost specific effects. Diathermy has already changed the statistical mortality and morbidity rate justifying a more optimistic concept of the course and sequelae of pneumonia. In the February issue of the ARCHIVES, Stewart has pointed out the marked success attained by various clinicians, independently of each other, when diathermy was used as a part of or as the sole agent in the therapeutic régime of pneumonia. Walsh confirmed the special virtue of diathermy in a group of 95 patients as compared with a control group of 59 treated without diathermy. Comparison of the mortality rate of both groups showed 12.4 for the former and 20.3 per cent for the latter. Stephenson of the United States Navy Medical Corps enhanced his clinical results to a reduction of the mortality to 8.4 per cent — a remarkable showing in comparison with former statistics.

Statistics in themselves are mere general indices which can have scientific value only through critical analysis. The element of coincidence and personal equation are factors which cannot be ignored. When, however, one considers that diathermy has been utilized in the treatment of pneumonia by a number of careful and unprejudiced observers for more than a decade, then the element of chance cannot enter into argument. To this must be added an appreciation of the scientific rationale of the action of diathermy. With the etiology and pathology of pneumonia firmly established it is easily conceivable that the deep heating action of diathermy influences the inflammatory process in the lungs to afford nature a more effective defense. Without here entering into a detailed discussion one needs only think of the greater defense of an infected organism produced by arterial hyperemia to appreciate the clinical importance of diathermization of the congested lungs. While it is not yet fully established that this physical agent or its improved counterpart, short waves, stimulate the reticulo-endothelial system, increased tissue metabolism in the form of enhanced oxidation as well as phagocytic defense undoubtedly play a vital rôle in the amelioration of existing pathologic processes. Under such a concept it is clear that administered at an early stage of pneumonia the clinical results would be proportionate to the technic brought into play. Just as indiscriminate and premature digitalization in pneumonia has done more harm than good, so either long or short wave diathermy must be administered in a manner suitable to individual indications. This implies that routinistic methods are out of place in a condition where the balance between life and death is exceedingly delicate. It is therefore imperative that every practitioner of medicine should be impressed with the necessity for familiarization with and utilization of long or short wave diathermy in every case of pneumonia at the earliest possible moment.

MEETING OF MIDWESTERN SECTION

The annual meeting of the Midwestern Section of the American Congress of Physical Therapy, which was held at the Mayo Clinic, Rochester, Minnesota, March 4 and 5, must be recorded as one of general interest. Under the leadership of its chairman, Krusen, a successful effort has been attained of combining the resources of the Mayo Foundation with those of the Congress for a highly profitable convention. Though bad weather and unfavorable location from the standpoint of accessibility were regarded as

possible factors likely to militate against a good attendance, the large Plummer Hall, in which the addresses and discussions were presented, was filled with an intent audience. The registration showed a representation of no less than twenty-two states with one physician hailing from far off New Zealand.

A large delegation including President-elect Bierman, of New York, boarded the train at Chicago on the eve of the meeting and in spite of a delay arrived in time for the opening of the session. The keynote of the gathering was sounded by Balfour, head of the surgical division of the Mayo Clinic, in an address of welcome which was a happy blending of the scientific import of physical therapy with its intimate relation to general medicine and surgery. Organized physical therapy is still young enough to gratefully appreciate acknowledgment of its scientific progress and clinical value by physicians and surgeons who have the right to speak for the general medical profession. And it was gratifying to hear from the lips of distinguished specialists that physical therapy has been accorded a large field of usefulness in the Mayo Clinic and its associated hospitals and institutions. Before the day's work was done, Henderson and Ghormley, of the orthopedic section of the Clinic, had demonstrated the rôle physical therapy plays in many affections handled by their department. Of equal importance was an address by the eminent physicist and biophysicist, Sheard, which apart of its masterly treatment of the subject of tissue heating by short wave electrical fields, gave the audience an insight in the extent to which experimental research is carried on in the domain of physical therapy. For the rest of the program we must refer the interested reader to the list of subjects published in the February issue of the ARCHIVES, with the statement that every address brought invaluable information of a scientific as well as practical character. The discussions were rather spirited and critical, proof that physical therapy is progressing along unbeaten paths.

The staff of the Mayo Clinic held a special meeting with the visiting members during the first evening, and while the subjects treated were not all nor solely devoted to physical therapy, the program had been prepared to include some phases of our specialty, if specialty it may be called. Three large and interesting clinics devoted to fever therapy, to corrective procedures for low back pain, and to general physical therapy were given March 5, as the finale of a memorable event.

Apart from the purely scientific value of the deliberations one could not but profit from a visit to a medical center with what may be termed a locale not duplicated anywhere in the United States. Rochester is a small town and free from the distractions commonly seen in large cities. It was inspiring to see a body of highly trained medical men entirely freed from economic problems and rivalries placed in a position to accomplish a share in scientific team work with the highest humane ideals as the only goal worth striving for. Whether engaged in research or in clinical work each member of the Mayo staff has opportunity to devote his entire energy to whatever work is assigned him without in the least losing contact with the progress achieved in other fields of endeavor. Between these workers and many members of our Congress the meeting brought about an *entente cordiale*, partly through the informal exchange of opinions and experiences and partly through purely human association, which can only serve as a stimulus for still greater achievements in the domain of physical therapy.

SCIENTIFIC EXHIBITS FOR 15TH ANNUAL SESSION

Applications for space for scientific exhibits at the 15th annual session in New York City, are now available. Members, guests, hospitals and teaching institutions are urged to participate. The space is offered without obligation. Prizes in the form of medals and certificates are awarded to outstanding exhibits which will be judged by an impartial committee.

It is hoped that our own membership will display a greater interest in this phase of our annual sessions. During the past two years the scientific exhibits have met with great favor and now are a permanent fixture so far as Congress activities are concerned.

If you plan to arrange a scientific exhibit for the 1936 gathering, reserve adequate space for the same. Applications are available by writing to the Chairman, Convention Committee, American Congress of Physical Therapy, 30 North Michigan Avenue, Chicago.

ABOUT MEMBERSHIP

On several occasions in the past we have published editorials on the desirability of increasing our membership roster. Several efforts have also been made by our membership committee, and recently our president has made a plea to which little response was manifested.

The Congress has progressed rapidly during the past five years. Hundreds of new subscribers have been obtained for the ARCHIVES, but with all this the number of new applications for membership has not been proportionate.

That there now exists a strong interest in physical medicine is exemplified by the enthusiastic sectional meetings and by the fact that such subjects as fever therapy, short wave diathermy and ionization are found on many medical programs. The medical profession generally has demonstrated an unusual appreciation for these newer contributions to science and is constantly seeking information on apparatus, technic and other developments.

The Congress has a certain responsibility in this connection. Its duties have multiplied and the vastness of its many functions has necessitated expansion in many directions. Recently its central office facilities in Chicago have been enlarged and its clerical force increased. The influence of the organization in physical therapy is being strongly felt and its scope extended.

To further the interests of the science and to carry on in a manner which will bring credit to the constituents of the Congress, our membership must be enlarged. We are seeking the aid of every member to do his share. One hundred new applications is the goal for 1936. Will you help to attain this goal? Secure one new application today — your associate, your assistant, your colleague. The central office will gladly send application blanks.

SOUTHERN SECTION MEETS IN NEW ORLEANS, MARCH 23, 24

The program of the spring session, Southern Section, American Congress of Physical Therapy, is now available. Morning and afternoon scientific sessions will be held on March 23, at Tulane University Medical School. An evening session has been arranged for a joint meeting with the Orleans Parish Medical Society. A full day of clinics, on March 24, has also been scheduled, the morning at Touro Infirmary and the afternoon at the Louisiana State Medical Center.

While this is the first spring session in the South, the splendid program and the enthusiasm which has been displayed by the local group assure a large attendance. It is hoped that our members in the South will make every effort to attend and to invite their colleagues to do likewise. There is no registration fee. Technicians and medical students are welcome.

While the sessions will be held in the teaching institutions, central head-

quarters will be established at the Jung Hotel. Reservations may be made by writing to the hotel direct. The dinner preceding the joint session with the Orleans Parish Medical Society will be held at the Jung and tickets may be secured when registering for the sessions at the auditorium of Tulane University Medical School.

The chairman of the Southern Section is Dr. Nathan H. Polmer, Maison Blanche Building, New Orleans; the secretary is Dr. Frank H. Walke, Ricou-Brewster Building, Shreveport, La.

SCIENCE, NEWS, COMMENTS

Dr. Anthony Bassler Honored

Dr. Anthony Bassler was made Consulting Gastroenterologist to Misericordia Hospital, Honorary Member of the Belgium Society for Gastroenterology, President of the National Society for the Advancement of Gastroenterology, President and Delegate of the United States Division of the International Society of Gastroenterology and Vice-Chairman of the Gastroenterological Section of the Pan-American Medical Congress.

Dr. Norman E. Titus Honored

A society for the ethical presentation of electrotherapy to the profession has been formed in London. It is composed of the outstanding medical men in the field who are cooperating to keep electrotherapy on a strictly rational basis.

The society is composed of: Professor *W. T. Turrell* of Oxford, *Sir Morton Smart*, *E. P. Cumberbatch*, *C. A. Robinson*, *F. Howard Humphris*, and *Ph. Bauwens*, Secretary.

This society has elected *Lord Horder*, Physician to the King, as medical consultant, and two foreign honorary consultants, Professor *Jean d'Arsonval* for France and Dr. *Norman E. Titus* for the United States.

Dr. Richard Kovács Honored

Dr. Richard Kovács has been selected as official delegate of the United States for the International Congress of Physical Medicine to be held in London from May 12 to 16, 1936. As already announced Dr. Kovács will conduct a group of American physicians to this conference which will include many places of historic interest.

Pacific Physical Therapy Association Meetings

The regular January meeting of the Pacific Physical Therapy Association was held January 22, in the Hollywood Hospital, where a Symposium on Low Back Pain was presented. The subject of the papers and participants were as follows: "Demonstration of Physical Therapy Applied to the Lower Back," by *Cora Smith King*, M.D., Director of the Department of Physical Therapy, Hollywood Hospital. Discussion: *Wm. W. Worster*, M.D., President, California College of Medical Technicians, San Gabriel, Calif.; "Anatomy of the Lower Back," by *Samuel Crooks*, M.D., Assistant Professor of Anatomy, College of Medical Evangelists, Loma Linda, Calif.; "Diagnosis and Treatment of Low Back Pain," by *Alfred E. Gallant*, M.D., and *H. Waldo Spiers*, M.D., Professors of Orthopedics, College of Medical Evangelists, Los Angeles. The February scientific session was also held in the Hollywood Hospital, February 26.

Medical Voyage to Morocco

A voyage for physicians and those recommended by them is being organized. The program as yet is unannounced. The itinerary is as follows:

Tanger, Tetouan (Maroc Espagnol), Ouezzan, route du Riff, Fes, Moulay-Idriss, Volubilis. Rabat, Marrakech, traversee complete du Grand Atlas par le col de Tizni-Test, Taroudant Agadir, Mogador, Safi, Mazagan, Azemmour, Casablanca.

The date of departure is April 4 from Marseilles, returning to the same port April 21. The price which is subject to forfeit if cancelled, is 3,885 French francs. All of those interested should communicate with "BRUXELLES-MEDICAL," 29 Boulevard Adolphe Max à Bruxelles.

Prize Offer In Campaign Against Rheumatism

During the Fourth International Rheumatic Congress at Moscow the Soviet Government offered the Council of the International League Against Rheumatism two prizes, of a thousand gold rubles each for the best work on a clinico-scientific and a social-medical basis. The jury was constituted as follows: Dr. van Breemen, Amsterdam, President; Prof. Kontchalovsky (Moscow), Prof. Danischewsky (Moscow), Prof. Ingvar (Lund).

In the meeting of the jury held in the University clinic at Moscow on the 15th and 16th, December, 1935, under the presidency of Dr. van Breeman, it

was decided, at the suggestion of the jury members from the Soviet Union, to declare the works sent in by Soviet Russia hors concours for this once, as the prizes were given by the Russian Government.

The prize for the best social-medical work was not awarded, while the studies sent in from Soviet Russia, and especially those of Prof. Danischewsky of Moscow, dominated so strongly that other work could hardly be considered.

The works on a clinical and scientific basis handed in by the Russians, especially those of Prof. Talalaef, also merit special mention.

It was finally decided to divide the two prizes into four prizes of 500 gold roubles each, and after long discussions they were awarded to: Doz. Dr. G. Kahlmeter (Stockholm), Doz. Dr. M. P. Weil (Paris), Doz. Dr. Ernst Freund (Wien), und Dr. B. Schlesinger (London).

Of the work done in the rheumatic field in the last decade, but not sent in for judgment, that of Prof. Klinge (Leipzig/Munster) deserves very special attention.

He has supplied an exceptionally important foundation for closer scientific research. Special mention should also be made of the work by: Bauer (U. S. A.), Brogsitter (Berlin), Burt (Bath), Warren Crowe (London), A. Fischer (Budapest), (formerly of Aachen), Timbrell Fisher (London), Gräff (Hamburg), Krebs (Aachen), Köhler (Bad Elster), Friedrich von Müller (München), Walter Müller (Königsberg), Nichols Wendel and Stainsby (New York), Osgood (Boston), Pemberton (Philadelphia), Payr (Leipzig), Pommer (Innsbrück), Poynton (England), Rigler and Wetherby (U. S A.), Schulhoff and Pap (Hungary), Stockman (Glasgow), Swift (New York), Umber (Berlin), Weissenbach et Françon, Forestier (France).

Among the works received, 65 altogether, those by D. Kling (U. S. A.), Buckley (England), Chini (Rome), Scott (London), Edström (Lund), Singer (Vienna) and some others were serious rivals for a prize.

The Soviet Government was requested by the jury to place some more prizes at the disposal of the Council of the Lique Internationale contre le Rhumatisme after the lapse of three years.

New Optical Methods Aids Study in Bacteria

A new optical method of studying the early growth processes and metabolism of bacteria and other one-celled organisms has been developed by Dr. Harold Mestres, research associate in the Department of Public Health at Yale University. Dr. Mestres explained the working of a new densitometer for studying the number of bacteria by the amount of light mixture of them in a solution will transmit.

With the instrument Dr. Mestres has been able to show not only that the growth of bacteria is quite different from older conceptions obtained by counting the growth rate at intervals, but has been able to follow the way in which bacteriophage controls growth of organisms. In addition the instrument will reveal the rapidity with which germicidal solutions stop the growth of organisms.

Taking a solution containing small organisms, growth can be traced, for as they grow larger and increase in number less light comes through the solution. Extinction of the light may even occur.

By measuring the transmitted light at intervals Dr. Mestres was able to show, what previous workers have suspected, that during the first hour or two of growth the bacteria grow rapidly in size and do not greatly increase in number. Then, at a clearly defined time multiplication sets in and the organism population increases. Cell metabolism is therefore highest at the beginning of cell growth and not, as is generally said, after a period of lag.

The study of the action of bacteria shows the organisms growing steadily up to the time when the phage was introduced into the solution. Then quickly the solution begins to clear up and allow more light to pass through. This indicates that the phage is "eating up" or destroying the bacteria.

First work on the development of the densitometer and its optical technique of studying bacterial growth was undertaken while he was at Stanford University, Dr. Mestres stated. The work is now being continued at Yale, where Prof. C. E. A. Winslow is chairman of the department. — *Science News Letter.*

Nobel Researches Set Off Bursts of New Knowledge

The Nobel prize awards to Prof. F. Joliot and Mme. Irene Curie-Joliot, in chemistry, and to Dr. JJames Chadwick in physics recognize two of the most important achievements in physical science in recent years:

Discovery of the neutron, now considered one of the three ultimate particles of all matter in the universe — the achievement of Dr. James Chadwick, now of Liverpool University and at the time of his discovery in 1932 at Cavendish Laoratory in Cambridge, England.

Discovery of artificial radioactivity and manufacture of new radioactive elements — the achievement of the Joliots, Parisian husband-and-wife research team, early in 1934.

The award to the Irene Curie, as she signs her research papers, marked the first cast of child of a Nobel prize winner receiving the Nobel prize. For Mme. Joliot is the daughter of the late Pierre and Marie Curie, Nobelists jointly with Henri Becquerel in 1903 for their work on radioactovity. The mother of Irene Curie also received the Nobel prize in chemistry in 1911, thus becoming twice a Nobelist, still a unique achievement.

The discovery of the neutron by Dr. Chadwick grew out of the modern alchemy of physics whereby transmutation is accomplished — not the sordid turning of lead into gold desired by the ancients but more important to science, the turning of many light atoms into other elements in small, but significant amounts. Lord Rutherford, Nobelist himself and head of Cavendish Laboratory, knocked "H" (chemical symbol for hydrogen) out of nitrogen in 1919. There was one light-weight element, beryllium, that resisted similar transmutation,

and it was an attack on this metal that produced neutrons.

When bombarded with a stream of helium atomic hearts let loose by that radioactive cousin of radium called polonium, there was produced from beryillium a stream of powerful radiation. The Joliots in Paris and two Germans, Bothe and Becker, thought that it was the well-known gamma radiation so useful in cancer treatment, but Dr. Chadwick recognized it as a stream of electrically neutral particles which had already been suspected from theory and had even been named "neutrons" before discovery.

Because of its electrical neutrality, the neutron has the ability to plunge itself into places that can not be reached by other atomic particles. It was immediately seized upon as a very welcome tool for prying open the atom. Used by investigators in America and elsewhere, it opened up a new bonanza of atomic knowledge.

Two years later the achievement of artificial radioactivity by the Joliots was world-acclaimed. The persistence and unchanging nature of natural radioactivity has perplexed scientists. Try as they will, they cannot speed, slow or otherwise change by an iota the constant natural disintegration of radium or any other radioactive substance.

Man-caused radioactivity was first produced in aluminum, familiar metal. A stream of helium atom hearts was flung at a thin foil of this metal. Out came first neutrons, and then a stream of positrons, another atomic particle discovered in 1932 by Dr. Carl D. Anderson, California Institute of Technology. What was unusual and important is that the positrons were flung off for many minutes after the bombardment stopped. The atom was disintegrated not like an explosive shell but like an incendiary bomb.

Here was radioactivity made to order. There was great activity in laboratories as atomic particles of various knds were flung by high-voltage current at various substances. A large number of substances weer transmuted into new radio-elements that lived for minutes, hours or a few days and then blew themselves up with release of powerful radiations.

There was hope aroused that these new radio-elements would be of medical and industrial importance. Today it is known that plans are under way in one laboratory at the University of California to produce radiosodium in quantity in the hope that eventually it can be used in the treatment of disease through its injection into the blood streams of the patients.

The chemistry prize awarded the Joliots is for this year and the physics prize to Dr. Chadwick is the 1935 prize. The 1934 physics prize, not awarded last year, will not be awarded at all but will be added to the Nobel fund for future prizes. — *Science News Letter.*

Lowly Sea Worm Helped Columbus Find America

It was a lighted sea worm, not a flickering torch in the hand of a native that Columbus saw from his flagship the anxious night before he discovered America.

With this biological explanation, one of the mysterious features of the discovery voyage is believed cleared up at last.

The light, which Columbus described as "like a small wax candle which rose and fell," was probably the luminous display of sea worms known as syllids, L. R. Crawshay of the Marine Biological Association Laboratory at Plymouth has reported. (*Nature*, Oct. 5) October is one of the months in which the illumination has been oted and it occurs usually around the last quarter of the moon, both points fitting America's discovery date. — *Science News Letter.*

"Bacteriophage" Saves Blood-Poisoning Victims

A life-saving method of treating blood-poisoning cases by injecting "bacteriophage" prepared from the patient's own blood will soon be announced through the American Association of Pathologists and Bacteriologists.

This use of "bacteriophage," or the "germ-eater" as it is popularly known, was developed by Drs. Ward J. MacNeal and Frances C. Frisbie of New York City. Twenty-five out of one hundred patients suffering from blood-poisoning were saved by this treatment, the local physicians report. All of the cases had been considered hopeless when the "bacteriophage" was given.

Drs. MacNeal and Frisbie are using a new technic in the "bacteriophage" treatment, giving much larger doses than they formerly dared to use. They find the larger doses to be safe and more efficient. — *Science News Letter.*

Brain Waves Give First Evidence of Brain Centers

Electric messages obtained directly from a human brain by means of an electrode inserted in the brain tissue have given scientists the first real direct evidence of a very strict division of labor in that important organ directing thought and action. The experiment was performed by Dr. Edmund Jacobson, of the University of Chicago, and was reported to the American Association for the Advancement of Science.

The muscles used in shutting the jaw are controlled in the brain center thus explored by Dr. Jacobson. This was indicated by the creation of the "brain waves" in that area when the subject closed his jaw. No other type of movement caused waves from this area, he found, although the subject moved his tongue, pursed his lips, frowned, clenched his fists, and moved shoulders and neck.

Even opening the jaws seems to have its control in a separate area, for this action caused no waves in the jaw-closing area. Neither did mental acts of remembering or doing mental arithmetic.

Dr. Jacobson has been waiting for years for a subject on whom such an experiment could be made, he told the scientists. Animals are not suitable because of the difficulty of training them to just the movements desired and no other at the same time.

The human subject finally obtained was a man who had lost a part of his skull in a previous operation on his brain to remove a tumor. Because of this the experiment was comparatively simple and entirely painless, for the brain itself is not capable of feeling pain. — *Science News Letter.*

Link Between Science and Public Urged in England

That there is need for "some method of closing the gap between the mind and outlook of the publicist and those of the trained scientist" was urged by Sir Frederick Hopkins, Nobel prize-winner for his pioneer researches on vitamins, in his valedictory address as president of the famous Royal Society of London.

"It is a just claim that in a civilization so largely based on science as that of today, the scientist should have more influence on policy than he has hitherto been allowed," Sir Frederick Hopkins said.

"Not long ago the gap in question was wide; it is now, I think, lessening. Occasionally at least, modern statesmen do seek scientific guidance, and, I think, know better than they did how rightly to obtain it. But it is time, perhaps, that the building of a bridge should begin on the scientific side of the gap. This is a task for organized scientific effort and the pooling of knowledge. As John Stuart Mill urged, knowledge before it can assist public action must somewhere be concentrated."

Sir Frederick Hopkins is a keen supporter for the movement for the establishment in Britain of a scientific news service similar to Science Service in America. He believes that the development of close contact between the scientific world and the general public is a social responsibility which falls, partly, on scientists themselves.

The new president of the Royal Society is Sir William Bragg, world-renowned physicist, who is director of the Royal Institution of Great Britain and of the associated Davy-Faraday Research Laboratory. — *Science News Letter.*

No Real Decline of Mental Power With Increasing Age

"An unfortunate libel" was the term Dr. Irving Lorge, of Teachers College, Columbia University, applied to the popular idea that aged persons decline in mental ability with advancing years.

Speaking before the meeting of the American Association for the Advancement of Science, Dr. Lorge said that the deterioration observed by psychologists and laymen is more apparent than real. It is due to a combination of dimming sight, slowing movements, dulled hearing, and a preoccupation with life's problems cumulatively. It is not a loss of mental power as such, but rather an inability to work as fast with mental tasks, Dr. Lorge said.

Tests given to 143 unemployed adults aged from 20 to 70 years indicated that the apparent decline with age differs when different mental tests are used as the measuring stick, those tests involving speed showing the greatest decline. — *Science News Letter.*

Obituary

The Congress announces with profound regret the demise on February 15 of Dr. Clara Emerette Gary of Boston, Massachusetts. Dr. Gary was graduated from Boston University Medical School in 1885, at the age of twenty-five, and has been in active practice for more than half a century. She has been one of the first physicians to become identified with organized physical therapy and has maintained an active interest in physical medicine until her last illness. The Congress extends to her bereaved family their heartfelt condolence.

(*Continued from page 166*)

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THE STUDENT'S LIBRARY

DIE BIOLOGISCHEN GRUNDLAGEN DER STRAHLENBEHANDLUNG. [Sonderbände zur Strahlentherapie. Band XX.] (The Biologic Fundamentals of Radiation Therapy. Volume XX of Special Monographs on Radiation Therapy.) By Dr. med. habil. *Friedrich Ellinger* formerly Privatdozent for Radiology at the University of Berlin. With a Foreword by Prof. Dr. phil. *Walter Friedrich*, Director of the Institute for Radiation Research at University of Berlin. Paper. Pp. 255 with 78 illustrations and 3 colored plates. Price, Rm. 13.50, bound Rm. 15. Berlin and Vienna: Urban and Schwarzenberg, 1935.

For the first time in the literature of radiation the medical profession is presented with a contribution based not only on the physical and technical but also on the biologic aspect of radiotherapy. Though apparently the work impresses one as a monograph, the text in many respects resembles a compilation intended for instruction of students and practitioners. This difference becomes obvious in the presentation through the introduction of general definitions and expositions of basic problems including the morphology of radiation effects. The main text is divided into five parts; namely, (1) roentgen and gamma radiation, (2) corpuscular radiation, (3) ultraviolet light, (4) effects of light, and (5) general radiobiology and therapy. Each section though written concisely covers the entire field of radiation from every point of view and in a manner to enable practitioners to apply each type of therapy on a scientific basis. In spite of the actual great value of this book we note failures to emphasize at needed detail certain aspects of light therapy. Thus the entire subject of the treatment of erysipelas with ultraviolet is disposed of in a very few lines and the more recent contributions of English and American investigators have been ignored in the otherwise extensive bibliography. In a volume as pretentious as this one a good deal more than local color is to be expected, for science is supposed to be devoid of chauvinism, yet the author has given scant reference to the vastly important contributions by Hess and others. Nor is the book free from annoying typographic errors, e. g., pityriasis "versiculor" when it should be "versicolor." The name of the eminent Berlin physical therapist, Laqueur is indexed as "Laqueuer." These may seem trifling matters but in a work representing high scholarship greater editorial thoroughness and academic liberality should be exercised. To a lesser extent criticism is justified in the rather limited descriptions of therapeutic technic, the author evidently assuming that the reader is familiar with the proper employment of agencies under discussion. With these exceptions the work is invaluable to such an extent that it merits a revised edition not only in the original but in the English translation.

FOUNDATION OF SHORT WAVE THERAPY. An Introduction to the Physico-Technical Principles and Medical Application of Short Electric Waves for Physicians and Biologists. Physics and Technics by *Wolfgang Holzer*, Dr. Ing., Assistant at the Physiological Institute, University of Vienna. Medical Application by *Eugen Weissenberg*, Dr. Med., Medical Superintendent of the Short Wave Section, University Clinic for Nervous and Mental Diseases, Vienna. Translated by *Justina Wilson*, F. R. C. P., Edin., D. M. R. E., Cantab, and *Charles Dowse*, B. Sc., Eng. Lond., A. M. I. E. E. Cloth. Pp. 228 with 53 illustrations and 10 tables. Price, 12/6 net. London: Hutchinson's Scientific and Technical Publications, 1935.

Although the excellence of the original publication has already been warmly commented upon in a previous review, this could well bear repetition were it not for the fact that the present English translation bears all the indices of such a perfect and timely labor as to deserve major consideration. It is, however, only just to point out that much of the credit belongs to the authors who provided an authoritative and well balanced background for its translation into the English language. It contained to a high degree the necessary data for an introduction to the physico-technical principles and medical application of short electric waves for physicians, biologists and physicists. It demonstrated that the investigators of short wave therapy had already submitted tangible evidence of its biophysical, physiologic and clinical action. Accordingly the translators were provided with excellent material for their literary labors, which they have utilized in a highly creditable manner. In their preface Wilson and Dowse state that they have undertaken this praiseworthy task because they realized "that the development of short wave therapy in English-speaking countries was being retarded by incomplete acquaintance with the theoretical investigations and clinical work which have been pursued in the Continent for some years." With this the reviewer is heartily in accord, as he is with the translators assertion that "sufficient experience has not yet been obtained to permit dogmatic statements to be made, but the fundamental physical principles are familiar to engineers and physicists occupied with high frequency and high voltage phenomena . . ."

These remarks represent the keynote to the presentation of the text in the English language. There is no question that with this effort the translators have rendered the English-speaking profession a great service, for they have not only made accessible to those unfamiliar with the German language an outstanding work, but in a version free from the usual shortcomings of translations too closely adhering to the original idiom. The format, too, is in keeping with the plan to bring out

a genuine English work, so much so, that the illustrations and legends have been redrawn with an English terminology. The present edition contains all the available information concerning the physics and clinical application of short and ultrashort waves, thereby eliminating the contention that the Continental development of this new therapy is beyond reach to those unfamiliar with foreign languages. We are constrained to express our sincere appreciation to the translators and to the publisher for this timely and valuable contribution to the domain of short electric waves in medicine.

ROYAT TREATMENT IN CARDIOVASCULAR DISEASE. By *Pierre Noël Deschamps*, M.D. (Paris) Assistant Physician in Charge of the Cardiological Department, Lariboisière Hospital, Paris. Cloth. Pp. 108. Price $2.00. Baltimore: William Wood and Company, 1935.

Physical therapy in cardiovascular conditions is a topic little known to American clinicians, and this in spite of its great value. This is due not to lack of interest but to imperfect information. The author states in the preface of the English edition that the object of the book is to familiarize the English-speaking physicians with the benefits to be derived from thermal carbon dioxide treatment. The best known resorts for cardiovascular diseases with natural carbon dioxide baths are the Spa in Belgium, Bad Nauheim in Germany and Royat in France. This volume deals mainly with the balneologic aspect of the Royat treatment. Deschamps believes that for carbon dioxide therapy an appreciable content is not in itself sufficient, and that the water must be of adequate strength and pressure from the springs without pumping. The heat furthermore must be moderate and the springs numerous enough for various treatments. In his opinion many resorts possess these qualifications, but none of them to the high degree afforded by Royat.

ULTRA SHORT WAVE THERAPY. By *William H. Dieffenbach*, M.D., Consulting Radiologist to Community Hospital, New York. Cloth. Pp. 87 with 26 illustrations. Price, $3.00. New York: B. Westermann Company, 1936.

It is with a feeling of regret that we condemn so-called literary efforts on highly technical problems which evidently lack a scientific background. Much as is appreciated that the author of this small brochure is well intentioned, it is nevertheless felt that it would have been better if it had remained unpublished. A subject as important and controversial as ultrashort wave therapy cannot by any stretch of imagination be covered in a book of 87 pages, 17 of which are devoted to illustrations taken from the book of Fritch and Schubart and these unacknowledged. The book is devoid of the most important fundamentals and is apparently written with the enthusiasm of a neophyte. The very keynote or premise of the problem has been ignored by omitting the physical and biophysical aspects of short wave radiation. What there remains of the text is essentially an ostensible resumé of other publications, and a recital of their clinical cases. All in all, this small book is a demonstration of uncontrolled enthusiasm, which in spite of the author's palpable sincerity, lacks the material and erudition expected in works of a technical character. The literary standards set by authoritative writers in this field are so high that one must command full mastery of every involved problem before venturing to add to its literature. This is the only criterion acceptable for scientific publications with reference to the therapeutic value of short wave radiation.

THE MICROSCOPE. By *Simon Henry Gage*, Emeritus Professor of Histology and Embryology in Cornell University. Ultraviolet Edition (15th). Cloth. Pp. 589 with 291 illustrations. Price, $4.00. Ithaca, N. Y.: The Comstock Publishing Company, 1932.

Certain works are so impressive because of the totality of information introduced that they are eventually singled out as the classic in their field. Such is the impression obtained from the study of the contents of this book. The present edition, the 15th, has been brought down to date in a completely revised, rearranged and rewritten form in order to make room for the new facts that have inevitably grown up in this important field of study. Out-of-date illustrations have been replaced by new, exposition has kept pace with the newer discoveries in microscopy, and emphasis or additional clarification placed on certain pertinent topics. Thus a totally new chapter on the use of the ultraviolet microscope has been introduced, and special emphasis drawn to the physical analysis of structure by means of the dark-field, the polarizing microscope, and the microspectroscope. While it is unquestionably true that the addition of a multiplicity of artificial dyes has been responsible for appreciation of certain morphologic characteristics of visualized specimens, it is pointed out that the bright colored differentiations are really artifacts absent under normal conditions. With the greater facilities at our command, the author pleads to a return of the study of histologic and botanic material under living conditions by use of fresh tissues and organs under physical analysis made possible by the perfected dark-field, the ultraviolet and the polarizing microscope, and the microspectroscope. Our knowledge can thus be materially enhanced, and this independent of stains. In addition to a short introductory statement, an extensive bibliography and index, the work is divided into 14 voluminous chapters, with an outline for collateral reading. One closes the book with a feeling of deep gratitude to the author and publishers for sacrificing labors entailed in the production of this outstanding and practical contribution. This work should be within the reach of every physician who prides himself as progressive in his chosen field of medicine.

INTERNATIONAL ABSTRACTS

The Treatment of Pelvic Inflammation by the Iontophoresis of Acetyl-Beta-Methyl Choline Chloride. Adolph Jacoby.

Am. J. Obstet. & Gynec. **31:93** (Jan. 1) 1936.

Induction of pelvic hyperemia for non-operative treatment of pelvic inflammatory disease has been attempted with the Elliot apparatus, hot douches, diathermy, the radiotherm, and various external heating devices. Jacoby offers his experience with iontophoresis of acetyl-beta-methyl choline chloride. Oral and subcutaneous administration produce generalized flushing, sweating, increased salivation, lowering of blood pressure, increased pulse rate, intestinal peristalsis, and metabolism. Application by iontophoresis to the skin produces some general effects but mostly flushing and local elevation of temperature. Acetyl-Beta-methyl choline chloride is more potent and longer acting than acetyl choline, and differs from histamine in that the latter acts on the capillaries and the former on the arterioles.

The technic consists in introducing several six inch squares of gauze soaked in 20 cc. of a 1 per cent solution into the vaginal vault. This is connected with the positive pole of a galvanic current. A flat, moist, dispersive pad (6 in. x 8 in.) is placed on the lower abdomen and retained in place by a sand bag and pressure from the patient's hands. This is then connected to the negative pole. The current is gradually raised to 15-20 milliamperes and allowed to flow for 20 to 30 minutes. The current is then slowly shut off and the pack removed. Approximately 31 per cent of the drug is introduced. No douches are used, and the treatment is repeated every other day. In most cases, seven to eight treatments were required for results.

The patient has a general reaction as described above, but no local symptoms. The results with ten cases were reported. Seven with extensive pelvic inflammation were "completely cured." Several were relieved of a concomitant dysmenorrhea.

The method is still under advisement, but it seems likely that this procedure is superior in producing a pelvic hyperemia because of its more sustained action.

Treatment of Hay Fever and Hyperesthetic Rhinitis by Ionization. Lee M. Hurd.

Arch. Otolaryng. **22**:416 (Oct.) 1935.

The author reviews the entire subject, first considering the apparatus used for ionization. In this connection he believes that each type of apparatus has its adherents. It probably makes no difference which type is used, as clinically the patients have about the same degree of discomfort and the appearance of the membrane and the results are the same, no matter which apparatus is chosen.

A brief historical reference is made to Leduc's early beliefs, and ionization is defined. Reference is also made to the theories regarding the action of ionization, finally to the histological studies on dogs by McMahon and on humans by Hollender and Garin. "My own examination of polyp tissue before and after treatment with the same dose of ionization as that used by McMahon showed some increase in edema to a definite coagulative effect which had fairly well penetrated through the polyp, but no necrosis. It is possible that the difference between McMahon's findings and mine is the difference between normal mucosa and polypoid tissue."

The author discusses the work of Warwick and the technic which he advocates especially with reference to the electrode and the electrolyte. In analyzing the electrode Hurd found definite variations in the product as marketed and concluded that the formula need not be exact and is subject to modification and improvement. It is better to have the electrode of the same metals as the salts in the electrolyte, as the acid radical will attack the electrode and form more ions of the same sort.

The technic is described in detail with a suggested modification which the author believes possesses merit. Statistics of Warwick's and Alden's results are mentioned and a table compiled of cases treated by the method of Warwick during 1933 and 1934. These were based principally on seasonal hay fever, while Hollender's favorable results were obtained in cases of hyperesthetic rhinitis. A few representative case reports are cited, but the author because of changing technics is unable to tabulate his own results. In cases of hay fever in which treatment by ionization was used during the attack the percentage of good results has been high; in cases of hyperesthetic rhinitis over 70 per cent of the patients have become symptom-free.

Detachment of the Retina. F. Poos.

Deutsch. med. Wschr. **46**, 1934.

Until a few years ago, we were practically without therapy for this affection. Although even earlier, a few ophthalmologists had seen tears in the retina, with this affection, and had tried to cure them, Gonin is to be thanked for the first decided advance in therapy. A few years ago, he pointed out that complete cure could be brought about in many cases by closing the tears in the retina still present with igni puncture. The author describes the present state of this type of treatment. Gonin exam-

ines with the pupil maximally distended because the tear is usually in the upper portion of the retina and towards the periphery. He then marks the place found in a drawing of the retina with equatorial divisions, whereby the distances are estimated according to the diameter of the papilla. Sometimes it is necessary to repeat the examination several times, or to wait until the eye has had two days' rest and then repeat the examination. Then the area on the outer coating of the bulbus corresponding to the location of the tear is exposed, after anaesthetising the sclera, and an incision is made at the previously reckoned distance from the edge of the cornea, with the Graefe scalpel, so that the subretinal fluid flows off in as large quantities as possible. Immediately afterwards, the red-hot Paquelin burner is inserted a few millimeters deep into the vitreous body, for two seconds. Then the conjunctiva is sutured, binocular bandage, rest in bed with immobilization of the eyes; change of bandage and first ophthalmoscopic examination should only be done, if possible, after a few days. If the tear is not closed, the method is repeated 9-10 days later; sometimes results have only been obtained after 9-10 trials. — Gonin had 53 per cent cures with his method, other authors, 30-50 per cent. The results vary, of course, according to the determination of the indication, and will be better when the operator has learned to recognize the suitable cases and to operate early.

Guist-Lindner have introduced chemocaustic treatment in place of the cauterization. They localize the tear exactly, just as Gonin does, and then execute a series of trepan incisions one millimeter apart in the area around the tear. Thereupon, cauterization of the free-trepanned portion of the retina for one-half second with the caustic potash pencil, followed by neutralization with a ½ per cent acetic acid solution. A few trepan areas are perforated at the end, so that the subretinal fluid may flow off. — This method takes a long time and is difficult, especially for the operator without much practice, and may cause necrosis of the sclera and shrinking of the bulbus. At Lindner's University clinic in Vienna, 47 out of 61 uncomplicated cases were cured with this method.

Electrocoagulation has been employed by Weve-Larsson and a few other authors, to heal the tear. The method is very similar to that of Gonin. Instead of the Paquelin, conic needles are stuck into the region of the tear with the current turned on (50-200 ma.), and when they are removed, the retroretinal fluid is carefully drawn off. Or, according to Larsson, the operator may only perform a flat diathermy coagulation of the sclera, whereby the globe electrode is allowed to remain in place until the sclerotic contracts and shows a greyish-brown discoloration (pergamentation). This method has the advantage that numerous coagulation areas can be brought about in a short sitting without causing extensive inflammation. The cures are reported as between 40 and 60 per cent. Although it is too early, even today to give a final judgment, nevertheless, the electrocoagulation seems to have the most advantages, especially with large tears and defects of the retina. — Safar has modified the method, in that he uses small brushes with insulated handles as the active electrode, on which are stuck a number of fine needles, 1½-2 mm. in length. With these brush electrodes, after the current is turned on, the retinal area is »punctured with diathermy«, all at one time. — Finally, von Szily and Machemer employ galvanic electrolysis to close the retinal tear, with direct current of 10-40 ma.; but this method is not yet developed, and not much experience has been gathered, with it, so far.

Unfortunately time has shown that the anatomic healing is not always a permanent cure, as, when the disposition or the causative affection (age, myopia, vasomotor disturbances) persists, new tears in the retina, and thereupon, new detachment of the same may appear. — [Ars Medici **13**:237 (May) 1935.]

Liver Resection. Martin B. Tinker.

Ann. Surg. **102**:728 (Oct.) 1935.

Control of hemorrhage is by far the most important problem in liver resection. Oozing is apt to be profuse and persistent with ordinary cutting methods. The liver tissue is friable and frequently does not hold ligatures or sutures.

Electrosurgery seems well established as the standard procedure in many fields. The only records of its use for liver resection are three besides my own. Ward reports excision in 1930 of a liver sinus persisting one and one-half years following drainage of a large echinococcus cyst. The excision extended down close to the vena cava, and the hemorrhage was so well controlled that it was possible to close the abdomen without drainage; a good recovery followed. Howard Gray reports removal of a squamous cell epithelioma, grade 4, involving the region of the gall bladder, 12 cm. in diameter, by diathermy, controlling large bleeding points by coagulation, ligation and mattress suture. He emphasizes the value of diathermy in resecting malignant lesions which when dissected by knife would be exceptionally difficult. Coller, of the University of Michigan, began a resection of an adenocarcinoma of the left lobe by the coagulating current but discarded it in favor of the scalpel. A number of surgeons presented evidence of the value of electrosurgery at a recent symposium of the American College of Surgeons. The brain surgeons, following the leadership of Harvey Cushing, all use it. De Quervain of Bern, Switzerland, uses it in his goiter surgery. Its value in dealing with other highly vascular parenchymatous organs has been shown by both experimental and clinical experience.

The Photosensitivity of Chick-Embryo Cells Growing in Media Containing Certain Carcinogenic Substances. Margaret Reed Lewis.

Am. J. Can. **25**:2:305 (Oct.) 1935.

When certain cancer-producing hydrocarbons were added to cultures of chick embryo tissue,

the cells developed photosensitivity to, the electric light used for the study of cells in tissue cultures. The photo-dynamic action caused definite changes in the state of the cell photoplasms, which were often accompanied by inhibited cell division. This brought about a later occurrence of abnormalities of mitosis that duplicated many of the types of abnormal mitosis characteristic of malignant growths (Lewis and Lewis, 1932; Lewis and Strong, 1934).

Diathermy Treatment of Eye Diseases. G. Cepero and L. Comas.

Ztschr. f. Augenhkd. **84**, 1934.

The authors have used diathermy, aside from its use for all kinds of iritis — of the gonorrhoic and luetic types as well — in cases of interstitial keratitis, corneal ulcers, inflammation of the optic nerve, beginning cataract, clouding of the vitreous body, in all exudative inflammations and painful affections of the eye. Favorable results were obtained with this treatment. The therapeutic effect does not depend so much on the heat produced as on a direct effect on the disease produced by the high frequency waves. Contraindications are haemorrhagic affections, during haemorrhages, and septic diseases of the inside of the eye. Usually, 7-10 treatments were required to produce cure. The pain usually stopped after the very first treatment. With lues, the diathermy treatment was given before the specific therapy, and showed good results, even where the antiluetic treatment failed. Where there were affections of the teeth, they were treated after the iritis had subsided. Atropine was given from the very beginning, but no other medicament was given. — [Ars Medici 13:237 (May) 1935.]

A Simple Needle for Diathermy Treatment of Retinal Detachment. Harry S. Gradle.

Am. J. Ophthal. **18:10**:956 (Oct.) 1935.

The majority of operators today are treating detachment of the retina by the production of an adhesive choroiditis by some form of diathermy. It is fairly well recognized that the current should be applied to the sclera, either superficially or partly penetrating. Complete penetration of the sclera with direct application of the current to the choroid is to be avoided on account of the resultant inflammation and on account of the leakage of the subretinal fluid with consequent softening of the eyeball before the operation is completed. Consequently, it is desirable to use either individual pins of the Walker or Safar type that are left in place until completion of the operation or else a single needle that does not perforate the sclera completely. To that end, more than a year ago, Gradle devised a needle consisting of an insulated handle through which passes the insulated cord coming from the diathermy machine. At the end of the handle is a curved steel wire. Protruding backward from the end of the wire, at a moderately obtuse angle, is a platinoiridium tip, one-and-a-half millimeters in diameter, and the point as sharp as possible. The use of this needle greatly simplifies the operation.

The Behavior of Oscillating Currents in Complex Circuits. P. Bauwens.

Brit. J. Radiol. **8:94**:615 (Oct.) 1935.

The author contends that tissues introduced in ultra high frequency fields should be regarded electrically as a complex system of condensers shunted by resistances in series with more resistances.

It is held that, in addition to the heat generated by virtue of the Joule effect, and dielectric hysteresis, vibrations are set up in the tissues at a frequency double that of the field. These vibrations are essentially the result of the cellular structure of tissues and act as a mild irritant producing a mild inflammatory reaction.

The author postulates that non-specific defensive processes are elicited and that some intermediate substances akin to Thomas Lewis' "H" substance may possibly be liberated.

It follows that the bactericidal action of this therapeutic agent resolves itself into an indirect one due to the defensive processes initiated in the tissues.

Electrouterography. Henry C. Falk, and Ralph Nahon.

Am. J. Obstet. and Gynec. **30**:403 (Sept.) 1935.

Electrical methods are based on the familiar "action-current" of contracting muscle. As in the case of the electrocardiograph, two contacts are required to "lead off." The type of contact point varies. Some observers have used metal electrodes (usually silver), others have used physiologic or nonpolarizable electrodes. Leads have been taken in animals from points on the external surface of the exposed tube and uterus; in human beings, from the cervix, the rectum, the external abdominal wall, and even the extremities. The recording instrument has usually been some form of string galvanometer.

The Chronically Diseased Cervix as a Focus of Systemic Infection. Peter Graffagnino.

New Orleans M. and S. J. **87**:83 (Aug.) 1934.

Conization with the electrosurgical unit affords a simple and satisfactory method of dealing with simple cervical erosions, chronic cystic cervicitis and other chronic lesions of the cervix. Conization accomplishes complete extirpation of the endocervical mucosa with its underlying glands and the tissues in which they are imbedded, just as in the Sturmdorf operation, without impairment of the integrity of adjacent tissues, and thus removing in one treatment all the foci of infection.

The infected cervix has been found to be a frequent source of systemic infection, ranking

in importance of occurrence and consequences next only to the teeth and tonsils. Those not specializing in gynecology should bear in mind the responsibility of the cervix as an etiological factor in many general conditions and not overlook this foci of infection in searching for the etiology of such conditions. The outward appearance of the cervix is an unreliable indication of its probable systemic consequences. Extensive constitutional symptoms may depend on a particularly virulent organism or an unusually low degree of immunity on the part of the patient. The most satisfactory method of dealing with cervicitis is conization with the electrosurgical unit. It is a simple ambulatory procedure, accomplishing complete extirpation of the endocervical mucosa with its underlying glands. Since August, 1932, this method has been employed in more than 400 cases with very remarkable results. It accomplished relief of symptoms, with anatomic restoration of the parts as well as preservation of function, in approximately 95 per cent of the cases.

Effect on the Eye of the Yellow Light of the Sodium Vapor Lamp. James E. Ives.

Public Health Reports **49**:931 (Aug. 10) 1934.

The conclusions based upon the results of the study are as follows: Sodium light had no permanent effect upon the eye, either beneficial or detrimental, which could be detected by the clinical tests used, in a group of subjects performing intensive clerical work under this light for about four hours a day during a period of twelve weeks. A temporary contraction of the form field of about ten degrees on the temporal side was observed, under both the tungsten and sodium lights, for most of the subjects, as the investigation progressed, when the examination was made during the working hours of the subjects. This contraction of the form field, however, disappeared when the subjects refrained from any work requiring convergence for forty-eight hours. No significant differenee in the amount of work performed by the sodium and tungsten groups was observed.

Treatment Technic With the Inductotherm. John R. Merriman, Harold J. Holmquest, and Stafford L. Osborne.

The Physiotherapy Review **14**:107 (July-Aug.) 1934.

The recent development of a new high frequency generator called the "Inductotherm" has introduced a new method of heating body tissues. It has been shown that for the maximal rate of heat generation in an electrolyte a definite relationship exists between the conductivity of the electrolyte, the dielectric constant of the electrolyte, and the frequency of the current. To obtain maximal rate of heating in an electrolyte having the conductivity of physiologic salt solution, by applying the high frequency current directly as in diathermy or by means of an electric field, it would be necessary to employ a tremendously high frequency, so high in fact as to be impractical. All tissues do not have the same electrical conductivities. Physiologic saline solution has the electrical conductivity of blood plasma. As we decrease the concentration, we obtain solutions which correspond in electrical conductivity with less conductive materials such as blood, muscular tissue and so on, until we obtain a concentration electrically comparable to adipose tissue.

In all, 150 local treatments were given for arthritic joints, and in many cases several joints were treated simultaneously. In addition twenty hyperpyrexia treatments were administered.

The technics which we have used are satisfactory in actual practice. The flexibility of the Inductotherm permits physicians to devise other technics which may be equally effective and better adapted to the particular requirements of the patient. The authors give their technic with illustrations for the application to all joints and for electropyrexia.

Heat Distribution in Ultrashort Wave Therapy. A. Gebbert.

Klin. Wchnschr. **13**:1563 (Nov. 3) 1934.

Gebbert describes experiments on the influence of wavelengths on the heat distribution in the body during ultrashort wave therapy. It is advisable to see that the distances between the electrodes are considerable, in order to produce a favorable percental depth action. The best medium between the electrodes and the body is air; however, for practical reasons other mediums may be interposed, so that the effect of distance is attained. A good glass or a loose felt of sufficient thickness has been used. The thickness of the interposed medium is determined by the size of the electrodes. There were no sharply defined heat maximums in the various substances that served as test materials (bread, meat, leg of a hog), and on which different wavelengths were tried. To effect a uniform absorption of heat by the different mediums — skin, flesh, muscles, bones and marrow — it proved necessary to use rather short wavelengths (between 3 and 6 meters). The author advises that, before resorting to ultrashort wave therapy of internal organs the relative heating of which is not known as yet, experiments should first be made on tissues that are stratified in a similar manner in order to determine the heating of the tissue in relation to the tissues in front and behind it. He suggests that these preliminary tests can be made on a cadaver or on a phantom and thinks that this is the only way in which it can be determined how the ultrashort waves are best utilized. — [J. A. M. A. **104**:265 (Jan. 5) 1935.]

EFFECT OF CARBON ARC RADIATION ON BLOOD PRESSURE AND CARDIAC OUTPUT *

HENRY LAURENS, Ph.D., LL.D.

NEW ORLEANS

In order to lower high blood pressure Lewis[1] has stated:

> Known substances and proprietary preparations have been, and continue to be, produced in large numbers. . . . For each of these strong claims have been put forward, but none has come to be regarded as reliable or even offering much or any prospect of benefit. Perhaps the most striking reflection upon their value is the short period of popularity that each enjoys before it is displaced by a rival. The amount by which pressure is lowered by these remedies is not usually great and the fall is either transient or restricted to the period of the drug's administration. Many patients complain that they feel less fit under such treatment than without it and it is doubtful if the policy of lowering blood pressure is sound. There is no known method of lowering pressure, materially and over long periods of time; the most effective treatment is a suitably restful régime.

Considerable evidence that carbon arc radiation of sufficient intensity and duration of individual treatment lowers blood pressure has accumulated since 1905, when Hasselbalch[2] of the Finsen Institute, showed that irradiation with a carbon arc (150 amps., 65 volts) produced a lowering of the blood pressure of normal persons, averaging 8 to 10 per cent, as well as that of patients with angina pectoris. The individual irradiations were severe, lasting for at least an hour, and repeated not oftener than every five days in order to avoid pigmentation, and to produce again and again a marked dermatitis with hyperemia and erythema. The cutaneous hyperemia affording mechanical relief to the heart and large vessels, was believed to be the cause of the lowered mean pressure. There was no definite or significant influence on the pulse rate.

In Hasselbalch's hands the superficial dermatitis produced by exposure to a quartz mercury arc had no other result than blistering and peeling of the skin and the caliber of the peripheral vessels was not influenced. Irradiation with the carbon arc, on the other hand, resulted in a long-lasting overfilling of the skin vessels with blood, and in a skin which was objectively warm. If the peripheral resistance in the small cutaneous vessels is lowered there must necessarily be a diminution in the pressure in the middle sized arteries where blood pressure is usually determined, and consequently the load on the heart and large vessels in the ejection and propulsion of blood must be diminished. Subjectively the respiration seemed fuller and freer although total pulmonary ventilation was, if anything, actually decreased, the rate of breathing diminishing. The deeper respirations probably improved the circulation by aiding in the filling of the heart by means of the greater negative intrathoracic pressure thus produced. The body temperature rose during the exposure, between 0.4 and 0.6 degrees C. but as long as the dermatitis lasted the temperature of the skin was increased between 0.5 and 1.5 degrees C. and the subject felt his skin as unusually warm. The changed blood distribution with relative relief to heart and blood vessels, the decreased irritability of the respiratory center with increase in volume of the individual respirations, the increased blood flow to the skin and the decrease in emotional fluctuations which accompanies the improved sense of well-being were all taken as favoring the view that angina pectoris is one of the

* Read at the meeting of the Southern Section, American Congress of Physical Therapy, New Orleans, March 23, 1936.

* From the Laboratory of Physiology, School of Medicine, Tulane University of Louisiana.

conditions in which a therapeutic agent which produces a permanent skin hyperemia would be of benefit. When carbon arc irradiation is long continued patients often become uneasy, dizzy and easily fatigued when the erythema is maximal, all of which is doubtless due to a slight cerebral anemia caused by extensive peripheral vasodilatation.

Experimental and Clinical Studies

My colleagues and I have worked on dogs, normal men and hypertensives. A previous summing up[2] of our small series of 15 hypertensives, referred to the laboratory by various physicians, showed that in 10 of them definite lowering of the pressure was obtained by following a procedure patterned after that of Hasselbalch, that is to say, doses large enough to produce a second degree erythema (accompanied by a burning sensation in a reddened skin with moderate, granular exfoliation), and not too often repeated, so as to avoid adaptation (fig. 1). According to the sensitivity of the individual the irradiation periods varied from 25 minutes to an hour at a distance of from 60 to 100 cm., and the dosage from 25 to somewhat less than 100 g. cal. per sq. cm. of area exposed. After quietly resting for 15 minutes the blood pressure was taken. The subjects sat on a low stool stripped to the waist, the eyes being protected by goggles. The chest and abdomen were exposed first, then the left side, the back, the right side and finally the chest again. The intensity of the emitted energy of the carbon arc lamp used ranged between 0.797 and 0.820 g. cal. per sq. cm. per minute, its distribution was 5-6 per cent ultraviolet, 29-31 per cent luminous and from 63-66 per cent infrared, as determined radiometrically.

The factors which have been held responsible by various observers for the lowering of blood pressure by irradiation are diverse, namely: cutaneous hyperemia; diminished blood viscosity; production in the skin of depressor substances which, on getting into the blood stream, lower the peripheral resistance by producing peripheral vasodilatation; the breathing of depressor substances, such as oxides of nitrogen set free by the arc; sympathetic hypotonia. Sheard[4] believes that the chief cause of the reduction in blood pressure is to be ascribed to the dilatation of the capillaries with an increase in the number of open or functioning capillaries of the skin and superficial tissues, thereby producing a decrease in the peripheral resistance to blood flow. Without doubt, too, he thinks, irradiation of the skin produces a disturbance of the balance between the peripheral sympathetic and splanchnic parasympathetic tone. Further, he believes that irradiation causes the liberation of substances with histamine-like properties and action, leading to dilatation and increased permeability of the blood vessels. Sheard has also observed that after irradiation the temperatures of irradiated areas in an arm or leg of a human subject are higher than in corresponding areas in the non-irradiated extremity. Increased temperature is indicative of increased blood supply and, therefore, of increased blood flow or decreased circulation time.

Cardiac Output Before and After Irradiation

I suggested to one of my students[5] that we study the cardiac output in hypertensives and normals before and after carbon arc irradiation. The only direct measurements of the influence of such radiation on cardiac output are those of Lindhard[6] who found the minute volume output to increase in 4 and to decrease in 3 of seven subjects whom he studied. Lindhard concluded that the effect of irradiation was first and foremost a cutaneous dilatation which, if not counteracted in some way, would produce an increase in the minute volume flow of blood. Since, however, the regulating power may be

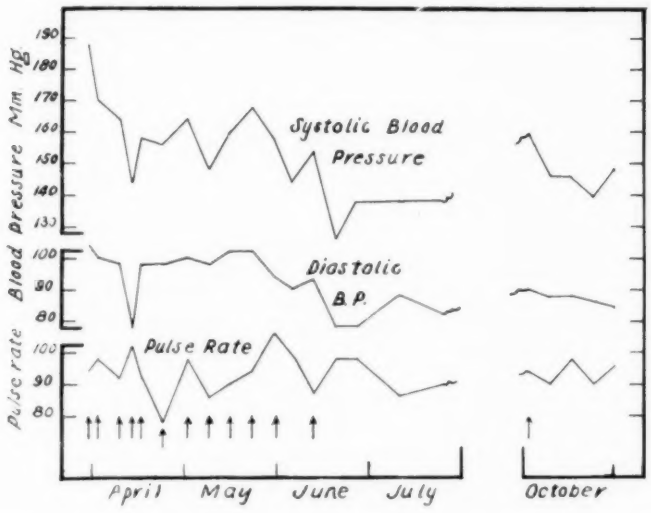

Fig. 1. — A typical case illustrating the lowering of blood pressure by repeated carbon arc irradiations.

different in different subjects, or in the same subject at different times, the end result, he believed, might be either an increase or a decrease and could not be foretold.

The general plan was to establish a normal base line for oxygen consumption, cardiac output, blood pressure, pulse rate and, in some cases, hemoglobin content of the blood and then to follow these functions daily after single measured doses of carbon arc radiation. All of the observations were made with the subjects in a basal state, the tests being run in the forenoon from 12 to 16 hours after the last meal, after a one hour rest in a steamer chair or bed and without any strenuous mental or physical exercise since the day before. Cardiac output was determined by the acetylene method of Grollman[7], oxygen consumption with the Benedict-Roth metabolimeter, and hemoglobin by direct measurement of the oxygen capacity by the manometric method of Van Slyke-Neill[8]. Pulse rate and blood pressure were usually determined three or four times during the preliminary rest period as an index of the degree of relaxation, but only the last readings were recorded.

The source of radiant energy was an "Eveready" carbon arc. National "Sunshine" carbons (ultraviolet 6 per cent, luminous 50 per cent, and infrared 44 per cent) were burned in all except a few experiments where "C" carbons (ultraviolet 9.0 per cent, luminous 24 per cent and infrared 67 per cent) were substituted. The total energy with its spectral distribution was determined for each exposure by the radiometric method but the radiation intensity as varied (30-90 minutes at 70-100 cm.) in each case so as to produce a definite erythema (2nd and 3rd degree), accompanied by some tenderness and subsequent peeling but without blistering. The erythema usually reached its greatest intensity in 24 hours and then gradually disappeared during the course of the next 3 or 4 days. When there was more than one exposure of the same individual, the erythema was allowed to disappear and circulatory functions to return to approximately normal levels before the subject was again irradiated.

Fifty-two exposures were made on 20 male subjects. Of these eight were between the ages of 20 to 32 years and with blood pressures within the nor-

mal range (systolic = 94-112 mm., diastolic = 54-78 mm.), while twelve were hypertensive. The latter were all ambulatory, from 21 to 67 years of age with pressures ranging from 128-191 mm. systolic and 74-121 mm. diastolic. One had a general arteriosclerosis, one a mild interstitial nephritis, and the rest were essential. Ten of the subjects were studied in the U. S. Marine Hospital in New Orleans where they were patients at the time, and the other two made visits to the laboratory of physiology for irradiation and tests.

The results are summarized in figure 2. The most striking effect in both groups was the increase in cardiac output which followed the irradiation. In the twenty experiments on the normal groups there were only two in which the cardiac output did not show an appreciable rise (12 to 35 per cent) and these were both in the same subject. The average pre-irradiation value for the cardiac index in the twelve hypertensive subjects was 2.24, which is within the limits, 2.2 ± 0.2 liters per minute per square meter of body sur-

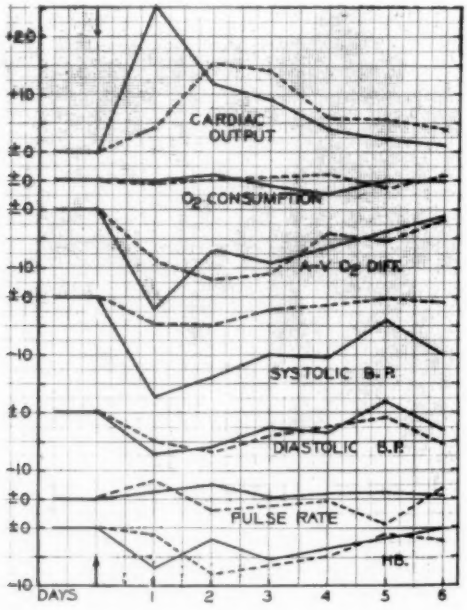

Fig. 2. — Average daily changes after single doses of carbon arc radiation. Normal (· · ·) and hypertensive men(—). The points are determined by the arithmetic average of the changes occurring on each day, expressed as per cent deviation from pre-irradiation values, except those in blood pressure which are given in millimeters of mercury.

face, given by Grollman[7] as the cardiac index for normal subjects, but the range of values for individual subjects was quite wide: 1.64 to 2.79. These figures are in agreement with those of Starr, Collins and Wood[9] who found that some cases of hypertension showed outputs above and others below the normal values. They noted a very close correlation between the cardiac output and the size of the heart and suggested that the low output values found in certain cases represent an adjustment by the heart, possibly at the expense of other tissues, to prevent an increase in cardiac work and development of cardiac hypertrophy. Following irradiation there was an increase in cardiac output averaging 39 per cent in 21, a decrease averaging 25 per cent in 6, and no significant change in 5. The maximal change was generally evident on the first day after the irradiation in the hypertensive, and on the

second or third day in the normal group, with a return to normal in from 4 to 6 days. Oxygen consumption showed only insignificant changes in all the experiments so that the changes in the arteriovenous oxygen difference are roughly reciprocal to those of cardiac output. The results on oxygen consumption are in agreement with those of Eichelberger[10] and of Fries[11] and directly contradictory to those of Lindhard[6] who reported that oxygen consumption increased in approximately the same proportion as cardiac output, while oxygen utilization of the blood remained constant after carbon arc irradiation. Lehmann[12] has reported that there is a difference between the acute and the chronic effects of ultraviolet irradiation. The outstanding early effect of a five minute, but intense irradiation, is an increase in basal metabolism, beginning five to seven hours later, simultaneously with the erythema, and disappearing in one to three or four days. On repeated irradiation the basal rate sinks gradually but definitely, not returning to its original value until from five to six weeks after the last irradiation. Although the pulse rate showed fluctuations above and below pre-irradiation levels, they were in no case greater than normal variations during the control period. With this relative constancy of pulse rate, the output of the heart per beat necessarily increases in the same ratio as the minute output, thus suggesting an explanation for the finding of a fuller and stronger pulse after irradiation as reported by some investigators.[13]

The blood pressure changes in the normal group are slight but with a definite tendency toward a lowering (6 mm. systolic and 8 mm. diastolic) lasting one to two days and with a slight increase in pulse pressure. These changes are of similar magnitude to those reported by Kimmerle[14] and Hasselbalch.[2] Changes in the hypertensives, particularly of the systolic pressure, are more marked and lasting, there being a definite fall in thirty-one of the thirty-two observations. The maximal depression of the systolic pressure ranged from 2 to 41 mm. Hg. (average = 17), that of the diastolic 2 to 20 mm. (average = 7). Since the depression in the systolic is relatively greater than in the diastolic, there is a definite decrease in the pulse pressure.

Hemoglobin estimations were made in 29 experiments to provide information regarding changes in blood volume. While the changes in hemoglobin do not follow quantitatively the blood volume changes, they may undoubtedly be used as an indirect criterion for determining the qualitative changes which occur, particularly when the hemoglobin values decrease. On the other hand, when the values show no change, or a slight increase, the addition of extra hemoglobin to the circulating blood may have overshadowed the tendency to dilution which would be produced by an increase in fluid content. The results of these determinations show that in both groups there is a predominant tendency for blood volume to increase after irradiation, since in 17 cases the hemoglobin content of the blood decreased from 5 to 11 per cent in 10 cases there was no significant change and in only 2 experiments was these any indication of an increase.

Comment

Whether or not the increase in cardiac output after an irradiation in normal individuals is a compensatory reaction is impossible to say. The decreased blood pressure may be a direct effect of vasodilatation and the increase in cardiac output and blood volume compensatory reactions to prevent the fall in blood pressure from being too great. On the other hand, the changes in cardiac output and blood volume may be purely mechanical effects resulting from the lowered peripheral resistance and diminished hydrostatic pressure. If hypertension is a compensatory reaction then the increased sensi-

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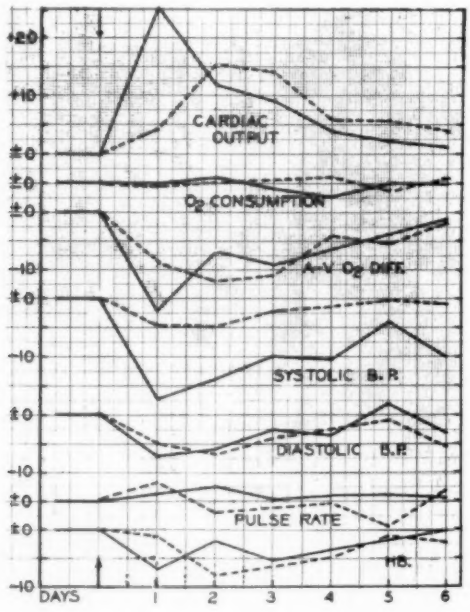

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tivity of the hypertensive group may be regarded as a further attempt on the part of the circulatory system to maintain a compensated state after the vasodilatation produced by the irradiation. The increase in the cardiac output in some subjects after irradiation, and the absence of an increase in others, suggests further the possibility that this ability to compensate may be better developed in some individuals than in others. If, on the other hand, the increased cardiac output is a mechanical result of lowered peripheral resistance, then it should occur in every instance where there is a fall in blood pressure. The same holds true for the blood volume; if the changes are purely mechanical, then there should be an increase every time the blood pressure is lowered. But, like the cardiac output, there are several instances, corresponding in practically every case with a diminished cardiac output in which the blood volume also decreases. This makes it seem quite likely that the changes in these functions are compensatory, but that there are varying degrees of ability to produce this compensation in hypertensives. Where it is least developed the cardiac output and circulating blood volume may actually decrease, due to the production of a near shock-like condition in which there is a varying degree of capillary stasis. In normals this ability to compensate, although not necessarily any greater, is of more frequent occurrence, so that in practically every case there is an increase in the cardiac output and blood volume.

That hypertensives are more sensitive to radiation than normals is suggested by the work of Ellinger.[15] Using erythema production on the arm as his criterion, he found the sensitivity in a group of 12 hypertensives between the ages of 20 and 50 years to be nearly 1.5 times as great as in normals of the same age. In 23 patients over 50 years of age it was 2.5 times as great as the normal for the same age. Due to the small size and heterogeneity of the group, Ellinger does not draw any definite conclusions from his data. The evidence is strengthened, however, by his study of a group of 13 individuals with low blood pressure in which the sensitivity was only half of what it is in normals. Ellinger suggests that the increase in sensitivity, which he has demonstrated in other conditions as well, may be tied up in some way with improved circulation in the skin due to an increased number of open and functioning capillaries, in turn due to increased thyroid activity.

The vasodilatation produced by irradiation is considered by some to be limited to the skin area while others believe it extends to the internal vessels as well. If the reaction is only superficial, the increased blood volume speaks against any marked degree of compensatory vasoconstriction elsewhere with merely a redistribution of blood. Often, particularly in the normal subjects, the greatest increase in cardiac output occurred on the second or third or even the fourth day following the exposure, while the erythema always reached its height during the first 24 hours. This would suggest a gradual spread of the vasodilatation, which might be best explained by assuming that some H-substance is liberated from the skin and circulated through the body. Much more information is needed as to the action of H-substances in normal and hypertensive individuals before these questions can be satisfactorily answered. Weiss, Ellis and Robb[16] studied the effects of histamine following continuous intravenous injection in human subjects both with normal and elevated pressures and found that in doses of from 0.02 to 0.04 mg. per minute the blood pressure either remained unaltered or underwent very slight, transient and inconstant fluctuations both upward and downward. They continued their injections of histamine over a relatively short period of time as compared with a 2 or 3 day period, and whether or not a continuous production of even smaller amounts over a prolonged period such as this would have a greater effect is not known.

Summary *

1. The changes in cardiac output, blood pressure, oxygen consumption, pulse rate and hemoglobin content have been studied in a group of normal and hypertensive men after single, erythema producing, doses of carbon arc radiation.

2. In normal men the blood pressure showed a slight lowering (6 mm. systolic, 8 mm. diastolic) lasting 1 to 2 days accompanied by an increase in cardiac output averaging 21 per cent. The highest value for cardiac output was reached on the 2nd or 3rd day after irradiation with a return to normal by the 5th or 6th day. Only insignificant changes were found in oxygen consumption.

3. In hypertensives the average drop in systolic pressure was 17 mm., (range, 2-41), in diastolic 7 mm., (range, 2-20). The cardiac output increased in twenty-one instances by an average of 39 per cent, decreased in six by an average of 23 per cent, and showed no significant change in five. The changes in oxygen consumption and pulse rate were small and inconstant. Hemoglobin changes indicated that, as a rule, whenever the cardiac output increased there was a corresponding increase in the blood volume and when it decreased there was possibly a diminution in blood volume.

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* It is a pleasure to record our thanks to Major T. B. H. Anderson, superintendent, and to Major W. I. Hollingsworth, the commanding officer in charge of the U. S. Marine Hospital in New Orleans for permitting us to work in the hospital. The "Eveready" professional model lamp and generous supplies of carbons were placed at our disposal by the National Carbon Co., Cleveland, to whom we express our thanks, and particularly to Dr. M. J. Dorcas.

FEVER THERAPY *

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Credit for the introduction of malaria therapy is generally given to Wagner v. Jauregg, but it would appear that Rosenblum, of Odessa, really should be credited. At any rate, since 1918 malaria therapy has had considerable vogue. In the hands of some physicians the results have been worth while, and of others not so good. This variation has probably been due to a number of factors, one of which undoubtedly has been the facility with which malaria therapy could be used under satisfactory conditions.

Certain objections to this method of treatment have, however, been made. The idea of inoculating a patient with a second disease in order to cure one already present is not an appealing one. Many attempts to overcome this objection have been made by physicians who, instead of bacteria, have injected various crystalloid or colloid substances, or heteroproteins such as peptone, milk and casein. Others have injected vaccines prepared from paratyphoid microorganisms or from the streptobacillus of Ducrey (a preparation known as dmelcos). These preparations are known to induce a febrile reaction. If the action of malaria on paralytic dementia depends only on the fever, it would seem that fever induced by any other method should be equally effective. Some physicians contend, however, that the favorable influence of malaria on syphilitic lesions is not merely an effect of the resulting increase in temperature, but that other factors also play a part. These other factors, however, have not yet been clearly defined, nor is it definitely known that they exist.

The injection of chemical substances or of vaccines for the purpose of inducing fever has given only partial satisfaction. Many who have attempted to use these agents have had difficulty in regulating the degree of temperature or in maintaining the temperature at a certain level for a sufficient period. This difficulty has led to a continued search for some physical means of raising the temperature of patients for therapeutic purposes.

Physical Methods

Among the various physical methods that have been tried may be mentioned hot baths, conventional diathermy, short wave diathermy, radiothermy, radiant light (infrared generator and carbon filament lamp), inductothermy, and air-conditioned chambers (Simpson-Kettering). Hot baths can be used effectively when the period of fever need not be long, but when it is desirable to maintain the fever for an extended period, this method becomes a distressing and debilitating experience for the patient and is difficult to use satisfactorily. By some, hot baths are used to raise the temperature to the desired level, after which the patient is transferred to a preheated bed or cot in which, by means of several layers of blankets, the fever is maintained. This is a clumsy method, but has the advantage of being less expensive than methods requiring specially constructed chambers. The difficulty of maintaining a certain temperature within a narrow range and the discomfort caused the patient are the main disadvantages.

Diathermy has been employed effectively, but this method requires the ap-

* Read at the Mid-Western Sectional Meeting of the American Congress of Physical Therapy, Rochester, Minnesota, March 4, 1936; and at the Meeting of the North Side Branch of the Chicago Medical Society, Chicago, Illinois, March 5, 1936.

plication to the patient of large ventral and dorsal electrodes, which must be carefully maintained in contact with the skin over a large area. This involves the use of a jacket which is firmly laced around the patient. Even with such a jacket contact may be broken by movements of the patient or otherwise, and burns may result. Such a method makes it impossible to keep the skin beneath the electrodes under observation. Another objection is that the fairly tight lacing of the jacket needed to maintain the electrodes in contact gives the patient a sense of constriction and respiratory oppression that is decidedly uncomfortable. Short wave diathermy has been used with considerable success. Until simpler and more effective means of inducing fever were available, long and short wave diathermy were the best methods. The use of short wave apparatus, however, has disadvantages that have caused many to give it up. Not only is the apparatus expensive and somewhat complicated, but the tendency of the current to arc towards pools of perspiration and thus cause burns makes it necessary to provide accessory equipment to evaporate the sweat as rapidly as it emerges from the skin.

Radiant light fever chambers are being used with more or less satisfaction. They are less expensive than certain other forms of apparatus designed for this purpose. An objection is that the elevation of temperature is rather slow. In treating certain conditions which require that a high temperature be maintained for several hours, undue slowness in inducing fever becomes a serious disadvantage, because the patient becomes fatigued before his temperature has attained the level at which it is to be maintained for some time.

Of the different forms of physical apparatus thus far designed for fever therapy, the one which seems the most effective from most points of view is the air-conditioned chamber known as the "Kettering Hypertherm." With it the temperature can be raised more rapidly than with radiant-light chambers, and any degree of fever can be attained and maintained for as long as the condition of the patient allows or requires. The patient's body (except the head which is outside) is entirely free within the chamber and the apparatus does not involve the use of contact electrodes, condenser plates, or other electrical appliances. The mechanism by which fever is induced consists of a simple air heater within the chamber and an equally simple means of humidifying the air to any desired degree. The heated and humidified air is then circulated around the patient at the rate of about twelve times a minute. The mechanism is placed in a small compartment at the foot end of the chamber, entirely separated from the patient by a substantial partition. The temperature of the air is controlled by a thermostat, and the relative humidity by a humidistat and by wet and dry bulb thermometric readings. With this apparatus the patient and the condition of the skin can be closely watched. The patient's movements are free; he is not restricted by confining jackets, and is not burdened by many layers of blanket. It permits the nurse or the attending physician to take care of the patient throughout treatment with the greatest ease. In case of emergency, also, the chamber can be thrown open and the patient withdrawn in a few seconds. These are advantages which do not exist to the same degree with any other method of fever therapy with which I am acquainted. It is possible that in the future simpler and less expensive means of inducing fever may be found. For instance, radiant-light chambers or chambers constructed on the principle of inductothermy may be perfected so as to remove the objections which now make these forms of treatment less satisfactory than they might be.

However simple the means of inducing fever may become, fever therapy is never likely to be an office procedure. This is especially true in connection with diseases the treatment of which requires that a high temperature be maintained for hours. The treatment should be conducted by specially trained nurse

technicians, who are not allowed to leave the patient until the session has been completed and the patient's temperature has returned to normal. Technicians should be supervised by a physician familiar with all phases of the method. If a technician must absent herself momentarily, her place should be taken by another technician or by the physician. Lunch is brought to them and is eaten during service. Under these conditions, and if the patients are carefully selected, only minor complications are likely to arise.

Contraindications

Fever therapy is a fairly strenuous test of cardiovascular function; therefore, patients over sixty years of age, or of any age who may be suffering from cardiac or renal disturbances, should not be subjected to it. Occasionally, the age limitation may be disregarded, but only when the condition of the cardiovascular apparatus has been carefully ascertained. Pulmonary tuberculosis may be and usually is a contraindication, chiefly because of diminished respiratory efficiency. Diabetes, if under good clinical control, is not a bar to fever therapy.

Technical Considerations

Patients enter the chamber in the morning, without breakfast, and usually food is not allowed until after the session is terminated and the temperature has returned to normal. Then they are given milk and are encouraged to take more at frequent intervals for twenty-four hours. The rate at which the temperature rises varies among different patients. In many cases a temperature of 106 degrees F. can be attained in sixty or seventy minutes; in other cases ninety minutes may be required before the temperature reaches this level. At the outset, as long as the temperature remains below 104 degrees F., rectal reading is taken every ten or fifteen minutes, but after the temperature has risen above this level, it is taken every five or ten minutes. As the temperature rises the patient perspires more and more freely. Thus, in the course of a five-hour session a patient might lose from 2 to 5 pounds (0.09 to 2.3 kg.) of water, which might involve a loss of a fourth to a third of the body chlorides. If measures to counteract such losses are not taken, the patient's weight will diminish correspondingly and a considerable degree of weakness from the loss of chlorides continues for several days. To obviate these undesirable effects, the patient is made to drink, throughout each session, from 1 to 4 liters of 0.6 per cent solution of sodium chloride. As a result the weight of the average patient increases, and the weakness which follows treatment lasts only from twelve to twenty-four hours.

Action on Pulse Rate. — The pulse rate increases rapidly at the beginning of each treatment, that is, throughout the phase of rising temperature. Then, the pulse rate tends to become stabilized, but the level of stabilization varies considerably. In some cases the pulse rate increases to 120 beats a minute and then oscillates at about this level during the remainder of the session. This is commonly seen with the more or less phlegmatic patient whose nervous system is stable. In other cases the pulse rate increases to 140 or 150 beats a minute and becomes stabilized at this level; in such cases the amplitude of oscillation tends to be greater. This is frequently noted in the patient whose nervous system is unstable and who easily becomes agitated. Between these two extremes there is a wide variation in reaction of the cardiac mechanism. If during treatment the pulse rate rises to 160 a minute, this is regarded as a signal of potential danger and the patient is closely watched. If the pulse rate should exceed 160 a minute, the rule is to withdraw the patient from the chamber and terminate the session without further delay. A fresh trial may be attempted two or three days later but, if the pulse does not behave more satisfactorily on the second occasion, further treatment is given up.

This rule, however, is not absolute and is subject to a few exceptions. Even with a pulse rate of 160, certain patients tolerate the treatment well, but when the pulse rate rises to this level or higher, the greatest vigilance must be maintained. Again, it may happen that the normal pulse rate of a patient (before treatment) may be higher than that of the average patient. During a session of hyperpyrexia, with the rectal temperature between 41.1 and 41.7 degrees C. (106 and 107 degrees F.), the pulse rate of one patient may be as high as 160, or even 180, without greater danger than in the case of another patient whose pulse rate at the same temperature has become stabilized between 140 and 150 beats a minute. I have had the opportunity to observe this phenomenon in one case, in which, at each of six sessions of treatment, the pulse rate rose to and oscillated between 150 and 190 beats a minute. The condition of the patient remained entirely satisfactory and the infection was rapidly cured.

Action on Blood Pressure. — During the phase of thermal elevation, that is, during the first hour of each session, the systolic blood pressure increases considerably. As a rule the systolic pressure increases by 20 to 30 mm. of mercury. But, after the maximal temperature has been attained, and during the entire period that it is maintained, the systolic pressure gradually falls, hour by hour, so that, at the end of a six-hour session, the systolic pressure is slightly lower than at the beginning. This drop in systolic pressure generally varies from 10 to 50 mm. of mercury. The diastolic pressure, on the contrary, does not rise during the period of thermal ascent, but slowly falls throughout the period of developing hyperpyrexia. In the majority of cases the total fall varies from 10 to 35 mm. of mercury.

Like the pulse, the reaction of the blood pressure to heat is subject to individual variation. In itself, the significance of this variation is slight. What is important to know and to watch attentively is the variabilty of the pulse pressure and pulse rate of each patient, which is to say, the differential variations between the systolic and diastolic pressures of the same patient. This is the most accurate index of the condition of the patient and of his ability to tolerate an increase in temperature. If the pulse pressure diminishes, one must be on one's guard, but if the pulse pressure falls to 20 mm. of mercury or below, the patient should immediately be withdrawn from the chamber and the treatment terminated. Such a fall in pulse pressure must be taken as a warning of cardiovascular insufficiency.

Tolerance of Patients. — In general, the treatment is well tolerated. This is especially true when the disease for which the patient is treated does not require a temperature greater than 105 degrees. But even when treatment requires that a temperature between 106 and 107 degrees F. be maintained for from five to ten or more hours, the majority of patients tolerate it well. The absence of any toxic element and of the resulting chills removes an important factor in the discomfort associated with a high degree of infectious fever. Few patients become delirious at any time. A degree of excitement may be observed during certain stages of treatment, but codeine, pentobarbital sodium, or morphin are used to counteract such manifestations and to make the treatment seem shorter.

The manner in which a patient behaves during treatment is a faithful index of the character and temperament of the individual. The poised person, who is determined to get well, behaves accordingly. Even when the temperature runs between 106 and 107 degrees F., some patients hum, sing, chat, or smoke to while away the time. Others remain quiet or sleep. Nervous individuals and persons without fortitude or self-control are prone to fuss more or less and to ask to be released from the chamber long before the session is scheduled to end. Of course, this depends largely on the degree of fever. When the disease for which the patient is treated does not require a temperature

higher than 105 degrees F., as in chorea and chronic infectious arthritis (non-gonococcic), a large proportion of patients bear it with greater equanimity than those who are treated for gonococcic infection, in which a temperature between 106 and 107 degrees F. must be maintained five to ten or more hours.

Mode of Action

In infectious processes caused by various bacteria other than the gonococcus the favorable effect of fever therapy appears to result from a number of indirect factors. Fever is known to produce the following: (1), increased flow of blood; in order to throw off the excess heat, the heart pumps the blood more and more rapidly toward the capillary system of the skin and toward the lungs; (2), increased action of the sweat glands, to help in dissipating the heat; (3), increased rate of respiration, to help in dissipating the heat; (4), general increase in metabolism (about 8 per cent for each degree of temperature); (5), increase in the number of leukocytes, especially of the polymorphonuclear cells; this varies considerably in different patients, the increase sometimes being slight and the number of leukocytes sometimes doubling in five hours, the number of cells returning to normal in about twenty-four hours, and (6) decrease in sedimentation rate.

Other changes which may occur, but undisputed proof of which is not yet available, are: (1), increased phagocytosis, and (2), increased formation of antibodies.

In gonococcic infection, a body (rectal) temperature between 106 and 107 degrees F., maintained for five hours and repeated from one to five times at intervals of two or three days, destroys the microörganisms and rids the patient of infection in a large proportion of cases. As Carpenter, Boak, Mucci, and Warren have demonstrated, some strains of gonococcus are more resistant than others and their destruction may require that the period of fever be extended to six, eight, ten or more hours. Therefore, the degree of temperature and the time during which such a temperature is maintained are the two main factors in the influence of fever on infections of this character.

Indications and Results

Syphilis. — Since the development of physical methods of inducing fever arose from the attempt to duplicate or improve the results obtained by malaria therapy in certain phases of syphilis, it was natural that these methods should first be tested in similar conditions. These tests appear to have shown that in dementia paralytica, tabes dorsalis, and in syphilis of the nervous system generally, the results obtained by physical methods appear to be about the same as those obtained by malarial inoculation. The evidence is not yet absolutely conclusive because the number of patients treated in this way is not yet sufficiently large to permit a satisfactory comparison. Our own experience at the clinic has been too limited to enable us to draw conclusions. Of patients with syphilis of the nervous system we have had an opportunity to treat only a small number. Nearly all had been treated by other methods for a time; many had received previous treatment with malaria, to which they did not respond favorably or which, after a period of improvement followed by recurrence of symptoms, no longer had a favorable influence. A much larger number of patients will have to be treated, and a number of years must elapse before the relative value of physical methods and malaria therapy can be determined.

Bessemans, of Belgium, has made extensive investigations of the influence of heat on the initial lesions of syphilis. He found that when the chancre was exposed to a sufficient temperature, by any method except infrared rays, the lesion promptly healed. Others, such as Neymann and Simpson in this country, have observed a like effect of heat on similar lesions in human beings. But it ap-

pears that the rapid healing of the primary lesion does not prevent secondary lesions from appearing later. For this reason, as far as the treatment of syphilis is concerned, the tendency now is to recommend that fever therapy and chemical treatment be combined. It is still too early to know definitely what the results of such a combination may be, but the indications are that a combination of the two methods yields better results than either method alone.

Multiple Sclerosis. — Our own experience with fever therapy for this condition has been so limited that we are not in a position to make definite statements. Those who have had greater experience than we, feel that many patients derive more or less substantial benefit.

Chorea. — The experience of others as well as our own indicates that fever therapy is perhaps the most effective way of controlling an attack of chorea. Thus far we have treated nine children with chorea, and all have improved satisfactorily. The patient's temperature was raised to between 103 and 104 degrees F., and was maintained at this level for three or four hours each day for one week. From day to day the choreiform movements diminished perceptibly, and in a week's time the attack had passed. A longer experience will be required to obtain a correct perspective on the value of artificial fever in comparison with other methods. The possible influence of artificial fever on subsequent attacks must, for the present, remain unsettled. One thing seems certain: If the therapeutic value of injecting vaccines prepared from paratyphoid or other microorganisms depends on the fever thereby induced, the induction of fever by an efficient physical method should make for improved results, because the fever can be effectively regulated.

Asthma. — Many who have had extended experience with fever therapy for this disease have reported favorable results. The number of cases recorded, however, is not sufficient to give a clear idea of the degree of improvement that may be obtained and how long such improvement may be expected to last. Our own experience at the clinic has been so limited that we cannot express an opinion on the therapeutic value of artificial fever. Since many patients derive substantial, though temporary, benefit from roentgen treatment, and since this is a much simpler procedure for the patients, we are inclined to favor it in preference to fever therapy. Treatment with roentgen rays is reserved only for patients who do not respond to ordinary methods of treatment.

Scleroderma. — A few patients with scleroderma have been subjected to a number of sessions of fever, without strikingly favorable results. The condition of one patient improved for a time, but it seems doubtful if the improvement will be maintained.

Arthritis. — Patients suffering from hypertrophic (senescent) arthritis do not as a rule appear to derive much benefit. In this variety of arthritis our practice has been to raise the patient's temperature to between 104 and 105 degrees F., to maintain it at this level for four or five hours, and to treat the patient once or twice a week. The condition of a small proportion of patients improves to a limited degree, but the majority of them obtain little or no improvement.

In chronic infectious (atrophic) arthritis, about a third of the patients derive substantial benefit, a third derive moderate benefit, and a third obtain little or no benefit.

A striking contrast is furnished by the results of fever therapy in cases of gonococcic arthritis. The rapidity with which the swelling and pain associated with this type of infection often subsides during and after a session of fever is really astonishing. When the articular inflammation is acute, the effect of fever therapy is often spectacular. In most cases thorough treatment is followed by complete and permanent resolution of the inflammatory process. When the infection is chronic, active inflammation and the accompanying symptoms abate and disappear, but when it has injured the articular structures and

has caused proliferation of connective tissue or deposition of bone, these changes as well as the resulting impairment of function are not influenced. The technic of treatment for such cases is the same as for gonococcic infection in general.

Gonococcic Infections. — The treatment of gonococcic infection with fever rests mainly on the experiments of Carpenter, Boak, Mucci, and Warren.[1] Having undertaken to investigate the influence of heat on the gonococcus, with the specific object of determining the degree and duration of temperature necessary to destroy the organisms, they made the following observations: In spite of considerable variation in the effect of heat on different strains of the organism, 99 per cent of the gonococci could not tolerate a temperature of 41 degrees C. for more than four or five hours, but the remaining 1 per cent were destroyed only after this degree of temperature had been maintained for from eleven to twenty-four hours. When subjected to temperatures of 41.5 and 42 degrees C., 99 per cent of the gonococci were destroyed in two hours, but the remaining 1 per cent had to be kept at 41.5 degrees C. from seven to twenty hours, or at 42 degrees C. from five to fifteen hours to assure their destruction.

Therefore, in treating any gonococcic infection the aim is to destroy the infecting organisms directly by subjecting them to a sufficiently high temperature for an adequate period. In practice it would be difficult to give the necessary treatment in a single session; but it has been found that repeated sessions of shorter duration are almost as effective, in fact, it is now possible to cure acute or chronic urethritis, with or without associated infection of the epididymis, uterus, tubes or joints, within three or four weeks, and often within two or three weeks. The certainty of cure is such that if, three weeks later, a patient tries to make us believe that the infection has recurred, we always succeed in making him admit a fresh indiscretion.

Between December 1, 1933, and December 1, 1935, 125 patients with simple or complicated gonococcic infection were referred for fever therapy. Twenty-five patients failed to cooperate or discontinued treatment for various reasons; these must be excluded from further consideration. Of the 100 patients who cooperated faithfully, ninety-two were cured; the eight other patients derived temporary improvement but were not cured, probably because the strains of gonococcus in these cases were unusually resistant.

In 10 cases the infection disappeared after 1 session of treatment.
In 27 cases the infection disappeared after 2 sessions of treatment.
In 24 cases the infection disappeared after 3 sessions of treatment.
In 16 cases the infection disappeared after 4 sessions of treatment.
In 4 cases the infection disappeared after 5 sessions of treatment.
In 5 cases the infection disappeared after 6 sessions of treatment.
In 1 case the infection disappeared after 7 sessions of treatment.
In 3 cases the infection disappeared after 8 sessions of treatment.
In 1 case the infection disappeared after 9 sessions of treatment.
In 1 case the infection disappeared after 10 sessions of treatment.

Each patient received two additional sessions after the gonococcus had disappeared.

From the foregoing it is evident that in the majority of cases less than six sessions of treatment were required to cure the infection. Thus, in sixty-one cases from three to five sessions were sufficient. One patient was cured after a single session. Herpetic lesions on the lips, and in the mouth, nose, and pharynx having appeared after the first session, further treatment had to be postponed. The patient was in bed nine days; eating and drinking were difficult. Smears prepared nine days after the session of fever proved negative, and two cultures made during the ensuing week also were negative. The patient has remained well.

These results would be even better if we could exclude a number of pa-

tients who were treated at the beginning of our experience. At that time the only fever chamber available was not air-tight and, until the significance of this defect was realized and remedied, it was often difficult or impossible to raise the temperature of some patients to the necessary level or to maintain it at this level for a sufficient period. This difficulty may explain why these patients were cured only after they had received nine or more treatments.

Of the 100 patients, sixty-eight were men and thirty-two women. Fifty-five were single, and forty-five were married. The average duration of the infection was three months; the shortest duration of infection was three days and the longest, six years. Fifty-five patients had the disease for the first time, while forty-five patients had contracted it for the second or third time.

In forty-five cases only the urethra appeared to be involved; in fifty-five cases various complications were found. Seven patients had associated pelvic infection, probably of the same character, although secondary infection may have played a part. Twelve had prostatitis. In thirty cases the urethritis was complicated by gonococcic arthritis; in three cases Bartholin's glands were infected; two patients had epididymitis; one had seminal vesiculitis; four had urethral sinuses; one had a periurethral abscess; two had prostatic abscesses; one had cystitis; two had pyelitis, and one had ureteral infection.

Therapeutic Complications. — As for complications occurring during treatment, forty-two patients complained of headache, which abated in a few hours. Nausea and vomiting occurred in the cases of seventeen male and fourteen female patients but, since the number of men treated was sixty-eight while the women numbered only thirty-two, the proportion of patients among whom nausea and vomiting occurred was much smaller for the men than for the women. In two cases the vomitus contained a tinge of blood, but it was impossible to discover any gastrointestinal lesions. The blood probably came from rupture of capillaries in the gastric mucosa, caused by retching. Muscular tetany of hands or feet was observed in two cases, and in a third case the tetany affected the abdominal muscles. Four patients complained of muscular pain, the cause of which remains unknown. In three cases muscular fibrillation with incoordinated movements was observed; two of these patients lost consciousness but recovered as soon as the temperature had fallen. Small vesicles appeared on the skin of twenty-four patients, and labial herpes was noted in eight cases. A single patient had diarrhea.

One patient with well-controlled diabetes had recently contracted gonorrheal urethritis. The first session of treatment was followed by a reactive flurry which promptly subsided. At the first four sessions it was impossible to maintain the required temperature for a sufficient period, but the subsequent sessions were more satisfactory. It was undoubtedly for this reason that positive smears and cultures were observed until after the seventh session.

To say that fever therapy is entirely devoid of danger, is contrary to fact. To date, the number of patients treated for various conditions has been 362, and these patients have received 1,810 sessions of treatment. I am sorry to have to report that, of this number, one patient died under treatment. The patient was a young woman with a pelvic infection. She had nearly completed her first session of treatment, which had been entirely uneventful, when her pulse suddenly fell. She was immediately withdrawn from the chamber, restoratives including carbon dioxide and oxygen were administered, epinephrine was injected into the heart three times, but, although the heart began to beat after each injection of epinephrine, respiration failed to return. It is not clear what may have been the factor or factors responsible for her death. This patient's temperature had risen readily, and not the slightest difficulty in maintaining her temperature had been encountered. At no time during the session

had her temperature risen as high as 107 degrees F. until just before the pulse collapsed.

This single death among the 362 patients treated gives a mortality rate of less than 0.3 per cent. Small though this is, the realization that death may occasionally occur from any method of treatment, still offers no consolation for the loss of this patient.

Reference

1. Carpenter, C. M.; Boak, Ruth A.; Mucci, L. A., and Warren, S. L.: Studies on the Physiologic Effects of Fever Temperatures, J. Lab. and Clin. Med. **18**:981 (July) 1933.

Discussion

Dr. William Bierman (New York): There is much in Dr. Desjardins' paper upon which one might comment. One of the very moot questions pertains to the relative merits of non-specific protein therapy and fever therapy produced by physical agencies. It is a very important question, because if it is shown that one has superior merits over the other, one method should be discarded in favor of the other. If it is shown, on the other hand, that temperature elevation, irrespective of the means employed to secure it, is the important consideration, then we can bodily take over the mass of data which have been accumulated these many years in the literature and apply them to fever therapy produced by physical means.

I know of no better way of coming to some conclusion than by observation of the physiologic changes produced within the human organism by these two methods. To attempt to evaluate them on the basis of therapeutic results is fraught with difficulty. There are too many clinical variables to permit us to reach any definite conclusion, except after a very long period during which many hundreds of thousands of patients have been treated for each of the various diseases for which fever therapy is indicated. But if we do observe the physiologic changes, we have definite objective evidence, upon the basis of which we may make comparisons.

There is a difference in the method of temperature elevation when we inject a typhoid vaccine, or some other non-specific protein into the human organism, and when we elevate the temperature by some heating agency. Except for that difference in heat production, or temperature elevation, there does not appear to be very many critical differences in the physiologic responses within the organism.

The point which I think we should emphasize, and to which Dr. Desjardins has called attention, is the fact that the mere elevation of temperature itself is something which is of importance only in conjunction with other changes. The living human is not an inanimate object. Clinicians are apt to concentrate their attention on the fact that the temperature of the body has become elevated from 98.6 to 105, 106 or 107 degrees F., and they appear to be oblivious of the other profound physiologic changes which occur when the body's temperature becomes elevated, such as changes in the velocity of the blood cells, changes in the number of white blood cells, changes in the body chemistry, changes within the blood serum, and changes referring to its bactericidal powers.

As to some of the points raised by Dr. Desjardins, I am going to choose possibly one or two, because we differ in our opinions. One, for example, concerns the action of temperature elevation on the sedimentation rate. We have studied that phenomenon in a goodly number of cases. It has been our experience that the sedimentation rate goes down and does not go up during the course of fever therapy. In instances like those of gonococcic arthritis where, to begin with, the sedimentation rate has been high, we observed a gradual recession of that rate to within normal limits. It may sometimes take a few weeks before the sedimentation rate comes back to within the normal range.

With reference to the leukocyte count, we made a series of 38 observations with hourly blood counts, and found in every instance very definite changes in the number of white cells, a diminution occurring during the first two hours of temperature application and then a very decided elevation, which averages some 80 per cent beyond the original figure. Accordingly there is a characteristic change, and the findings depend upon the time at which one makes the blood counts.

As to clinical results, much comment might be made here, likewise. I refer to just one clinical condition, namely, gonorrhea. We have been particularly interested in the treatment of gonorrhea in the female. To date we have treated 78 cases. It might be of interest to know that in our last group of eleven cases, we applied fever treatment only once to eight of these cases, and twice to the other three, which resulted in complete disappearance of the gonococcus. It may be therapeutically effective to administer a course of five to eight treatments, but I am reasonably certain that if any one went through such a series one would give a great deal to have avoided it. It is a very disagreeable treatment and occasionally even dangerous, as Dr. Desjardins has indicated. If one can obtain the same result in one treatment instead of eight, and do it quite consistently, I fail to see why one should repeat them.

The difference is but a matter of technic.

Dr. Clarence A. Neymann (Chicago): We must differentiate between malarial therapy and fever therapy, not because I believe they differ but because the advocates of malarial therapy have always dissociated malaria from fever therapy. They have always hinted at some peculiar virtue of the malarial germ, and have spoken in terms of cross protein immunity.

It was because I never believed in this cross protein immunity and this malarial fetish, as we might call it now, that Osborne and I began the work with electropyrexia and were the first actually to produce fever in man by means of electrical currents.

Now that production of artificial fever by physical agents is an established fact, the advocates of malarial therapy say, "Well, it is the temperature," but there is something in addition to temperature, and that something is a large death rate. In order to prove this, I will show a few slides, but before doing that I want to talk to you about the experiences and the work of Wagner von Jauregg.

Wagner von Jauregg was not the first to inoculate patients suffering from general paresis and from other mental diseases with malaria. Rosenblum of Odessa, was the first, and published the fact in 1876. This paper was translated by Oks into German in 1878. Wagner von Jauregg took up the treatment of general paresis with malaria while he resided in Constantinople and undoubtedly had access to both the work of Oks and Rosenblum. This work was done twenty-five to thirty years before Wagner von Jauregg began his own work. (Slides.)

The statistics I am presenting show 742 cases reported in the literature, which means that all the authors cannot be wrong all the time. Two hundred twelve have been reported in complete remission. Two hundred fifty-three are so much improved that they are no longer in need of hospital care. Sixty-four per cent of the patients treated with electropyrexia have recovered, which showed fairly conclusively what can be done in a large number of cases. The results are about twice as good as with malaria.

There were eighteen deaths among 700 cases. The death rate from malaria is between 10 and 30 per cent. To show you the difference between external and penetrating heat applications, we now use only electromagnetic inductions. Fifteen cases were taken at random from Dr. Simpson's group and the same number from my group, both series suffering from some form of syphilis. The temperature rose to 106 degrees, or nearly so, which was maintained six or seven hours, and each case was checked each quarter of an hour. We took the maximum pulse rate when penetrating heat was used by electromagnetic induction. As a rule, the temperatures being the same, the mean pulse rate of the cases treated by external heat was 20 to 30 beats higher than when treated by penetrating heat. The maximum pulse rates produced in the unusually susceptible patients are much higher when produced by external heat than by penetrating heat. I think that is very important.

We use electromagnetic induction now in combination with the bag or in combination with a cabinet where the temperature never rises above 105 or 110 degrees F. It will not, in itself, produce fever at all, but simply serves as a sort of blanket in which the patient can move freely. With this sort of apparatus, patients in advanced stages of diabetes, with organic heart disease, with advanced arteriosclerosis, with diseases of the liver, and the like, have been and are being treated, and our death rate remains virtually nil. We have treated over 1,000 cases, with only three deaths, and these at the beginning of our work: One, because we gave hot baths, which we have discarded; the second, a paretic, developed a convulsion during treatment, which is a serious complication; the third, a case of multiple sclerosis, was far advanced and should not have been treated.

One of the pleasant experiences to me is the fact that people are no longer afraid of high temperatures. With artificial fever produced by physical means, and especially by penetrating electrical currents, one can maintain temperatures of 41 or even 42 degrees C., or up to 106 degrees F., for five, six, seven or eight hours with comparative ease and without taking a great risk.

I can confirm Dr. Desjardins' results with chorea. We now have 24 cases of chorea, and all of them have recovered with an average of four treatments per patient.

Dr. A. U. Desjardins (closing): I am grateful for the comments, and especially to Dr. Bierman for calling my attention to an error in the paper in connection with the sedimentation rate. It wasn't delivered to me until this morning and I didn't have time to go over it. The sedimentation rate was put down as an increase instead of a decrease.

The reason we have not tried Bierman's modification in technic, which is apparently working out so well, is that the manufacturers who have been making these special electrodes, told me they were making improvements. I was waiting to hear whether the improvements had been completed, because I dislike making use of one improvement only to find another two weeks or a month later.

We tried in one case, for instance, to use diathermy in conjunction with the chamber of treatment, but the combination didn't work out in that case partly on account of the bad arrangements and also because it was an unsuitable case. I understand now the electrode is perfected about as much as it is likely to be, and we can perhaps go ahead and try it out. There is no question but that Dr. Bierman is entirely right in the sense that if one can get the same result with one or two sessions of treatment, there is no sense in putting a patient through five or six sessions.

NEWER ASPECTS OF IONIZATION THERAPY IN NASAL ALLERGIC DISORDERS *

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Inadequate knowledge of the nature of allergy frequently necessitates resort to non-specific measures in the management of vasomotor rhinitis. Lack of a scientific basis for the therapy of allergy in general leaves unsolved the problem why certain procedures prove effective in some and inefficacious in other individuals.

There is no intention to minimize the value of specific immunization in allergic disease. For an exact diagnosis in the group of cases with which we are concerned a complete allergic investigation should be made routinely. But it is precisely in vasomotor rhinitis that even painstaking efforts will fail in the determination of a specific cause. As a consequence non-specific measures, though their effectiveness can be explained only on an empiric basis, have been added to our therapeutic armamentarium.

Cauterization Therapy

Of the various local measures which have been tried, cauterization has earned widest acceptance. It is an old procedure, having been staunchly advocated by Sajous[1] as early as 1883 as a cure for seasonal hay fever. Sajous believed that by organic alterations of the nasal mucous membrane the hyperesthetic portions could be permanently annulled and thereby a cure of the condition brought about. That he was not alone in holding to this view is proved by the popularity which this treatment attained a quarter of a century later, other writers, especially Grayson,[2] and Lloyd,[3] claiming for it satisfactory results. Cauterization was defended by Grayson on the theory that the nasal condition is one of complete vascular relaxation, and that the treatment acts as a tonic stimulant rather than an irritant.

While some progress has been made with specific therapy during the past two decades, rhinologists generally have not become sufficiently enthusiastic about it to discard local procedures, even though many of these produce only temporary effects. Some workers have reluctantly adhered to the application of the cautery, because of the fact that often relief of symptoms was obtained at the price of destruction of mucous membrane. Chandler,[4] and Palmer[5] have recently called attention to the favorable effects of the intranasal application of phenol in hyperesthetic rhinitis, while Monson[6] has reported successes with the injection of sclerosing solutions into the inferior turbinate bodies.

Review of Previous Reports

We are primarily concerned with intranasal ionization, which recently has been brought prominently to the attention of the medical profession.[7] I have elsewhere pointed out the value as well as the limitations of intranasal zinc ionization therapy, and have stressed, first, that the method is only occasionally effective in seasonal hay fever,[8] and, second, that in the perennial affection, it is not a cure but a prolonged palliative.[9] Ramirez,[10] confirmed these observa-

* Read at the Mid-Western Sectional Meeting of the American Congress of Physical Therapy, Mayo Clinic, Rochester, Minnesota, March 4, 1936; and at the Southern Sectional Meeting, New Orleans, Louisiana, March 23, 1936.

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tions, but with the positive assertion that ionization has no merit for hay fever while for non-specific vasomotor rhinitis the treatment had improved the vast majority of patients in his experimental series.

Limitation of time does not permit a description of the technic of ionization, which is available in the literature. To prevent misconception it should be made clear that by ionization, a term synonymous with iontophoresis, we understand the introduction or transfer of metallic or other ions into the tissues by the galvanic current. In ionizing the nasal mucosa I make use of a two per cent solution of zinc sulphate as the electrolyte and of the simplest type of electrode to "drive" the zinc ions into the tissues.

I have employed ionization extensively in nasal allergic conditions for several years and have endeavored to formulate its rationale. While, as has already been stated, no claim can be made that it is a cure in spite of clinically satisfactory results, I have been gratified at the prolonged and complete symptomatic relief, never attained with galenical and biologic preparations.

Mechanism of Ionization

Research is now being carried on in an endeavor to rationalize intranasal ionization, since there is as yet no satisfactory explanation of its mechanism. H. L. and J. H. Alexander[11] came to believe that ionization is merely an effective form of cauterization. This was a deduction made without an investigation of the mechanism by which a slough is formed in the nose following ionization. They attribute the relief afforded by this procedure to a mechanical removal of the antibodies from the nasal membranes. As the restored mucous membrane is not sensitive, inhaled or ingested allergens evoke no response. They attempted by means of ionization to determine how soon the newly formed epithelial tissue would become sensitive, and believed that if the reagin content of the blood persisted, sensitization would return as soon as the new nasal tissues absorbed antibodies from the blood. On the other hand, if no reagin could be demonstrated in the blood the process of localization of new antibodies in the nasal membrane should be slower.

The Alexanders found that as a result of ionization on 53 patients the size of the initial cutaneous reaction did not change materially. The size of the reactions to passive transfer tests was somewhat variable, but this was attributed to the circumstance that it was not always possible to repeat passive transfer tests on the same persons. Eosinophilia was not particularly altered, eosinophils persisting in the nasal secretions even of patients who were relieved. Topical applications of the allergens produced a variable and inconsistent response. Seven of 9 patients who did not secure any relief showed demonstrable reagins in the blood. Reagins were found in only 3 of a group of 11 who were relieved. From these results it is conjectured that if patients have no reagins in the blood the chance of relief by ionization is greater.

Leduc[12] pointed out that the ions of the so-called heavy metals are all more or less caustic, probably because of their coagulating action on albumen. Friel[13] has demonstrated an antiseptic effect, while recent experiences with ionization particularly in nasal allergy have proved that modifications of sensibility of the nasal mucosa can be produced.[14] That the latter may be due to caustic action is theoretically probable.

Whether the physiologic mechanism of relief is purely local, or systemic, or local and systemic, as contended by Warwick,[7] is still open to question. According to Alden[15] the relief in certain cases of urticaria, asthma and migraine without nasal symptoms, which was secured by ionization of the nose, is difficult of explanation on the basis of a purely local change in the nasal mucosa, and indicates a far reaching effect of the treatment.

Without claiming to present conclusive facts, irrespective of the changes which take place in the nasal mucosa through ionization, there is no doubt that the ultimate effect is alterative in character. It is theoretically sound to ascribe the clinical results to alterations in the structure of the mucous membrane with a function definitely modified from that before ionization. It hardly needs pointing out that in nasal allergic conditions the mucous membranes manifest hypersensitivity or altered susceptibility to extraneous irritants. Clinical experience justifies the theoretic concept that ionization produces an alteration in the degree of susceptibility and hypersensitivity. To this should be added the view expressed by Rackemann,[16] that the problem of allergy, that is to say, the reason for the capacity to react to foreign substances, is probably fundamentally not very different from other problems, such as those of cancer — the reaction of the individual to tumor formation — or to immunity in general — the reaction to acute and chronic infections.

One should not lose sight of the multiplicity of factors involved in the problem of allergy. In about one-half of our patients, according to Rackemann, complications arise some of which can be explained by the occurrence of bacterial infections as secondary factors superimposed on the primary sensitiveness; while in another group the persistence of symptoms depends upon secondary, extrinsic causes. While it is difficult to differentiate these two groups, since both complications may occur at once,[16] the most striking results with ionization have been observed in those patients who, clinically at least, belong to the group with bacterial infections as secondary factors. Spectacular and prompt results in this group may be due to combined antiseptic and alterative effects of ionization. Failures with ionization therapy might reasonably be attributed to the existence of several complications in one individual, both of an extrinsic and intrinsic nature.

Histopathologic Changes by Ionization

The effect of ionization on tissues is a problem that has evoked careful investigation. McMahon[17] performed zinc ionization of the nose of dogs and found that it caused a fibrosis of the subepithelial tissues, which was seen to be progressively more marked and well established in the animals killed at intervals of from eighteen hours to seven weeks following ionization. Ionization of the frontal sinuses caused a similar fibrosis in dogs killed at seven and twelve weeks, respectively; marked hyperplastic changes in the bone being seen in the dog killed at twelve weeks. The epithelial changes in the nose consisted of primary destruction and later regeneration practically to normal, while in the frontal sinuses there took place an eventual transition to a cuboidal type of cell over the areas of greatest destruction.

Alden[15] examined nasal tissues removed from animals and humans ionized by the Warwick technic and has so far found no evidence of permanent nasal damage attributable to the treatment. There was noted, however, a moderate amount of fibrosis, but Alden's statement that this is probably due to old pathologic conditions cannot be accepted as conclusive.

Hurd[18] examined polypoid tissue before and after treatment with the same amount of ionization used by McMahon, and found some increase in edema due to a definite coagulative effect which had fairly well penetrated through the polyps, but without necrosis. Hurd believed that the difference between McMahon's findings and his, lies in the difference between normal mucosa and polypoid tissue.

Cottle[19] found that immediately after ionization there is a destruction of the surface mucosal epithelium almost down to the basement membrane. Dur-

ing the ensuing three months there occurred an infiltration chiefly of small lymphocytes, with a general increase in the density of the submucosal supportive tissues. In the majority of sections progress to a condition not unlike that of a true fibrosis was noted. While eventually regeneration of the destroyed epithelium took place, in a large number of sections Cottle failed to observe a regeneration of *ciliated* epithelium even in the nasal mucosa removed from patients ten years after ionization.

To correlate the histologic changes with the clinical results of nasal ionization, Gorin and I[20] studied numerous sections carefully taken from inferior turbinates. Sections made immediately after treatment revealed changes in the surface epithelium ranging from thickening to partial destruction, but with absence of cilia. At different periods after ionization there was gradual regeneration of surface epithelium, first as squamous cell formation, and at three months as a pseudostratified form, the cilia being consistently absent in all sections. The subepithelial stroma showed a gradual tendency towards structural density with early marked lymphocytic reaction subsiding slowly but persisting in a lesser degree for several years. These histologic studies disclose in brief that ionization produces a change resembling fibrosis.

No harmful clinical effects have been observed one to ten years after ionization. In view of this fact it is questionable whether McMahon's fear is justified that ionization would eventually bring about a condition which might be aptly termed a premature nasopause. When it is taken into consideration that more pronounced destructive effects have been brought about by chemical and electric cauterization, electrosurgery, electrolysis, various sclerosing solutions, and particularly by the more recently advocated phenol application to the entire nasal mucosa, is it reasonable to assume that the milder ionization could produce permanent harmful nasal symptoms?

It is fully appreciated that the influence of ionization on the physiology of the nose remains to be more accurately determined. In spite of favorable clinical results, one cannot dismiss the subject of permanent damage to the cilia without due consideration, especially so in the light of recent investigations on the significance of ciliary function.

Clinical Observations

In our present series we have treated a total of 150 patients with nasal allergy by zinc ionization. Their grouping according to type and complications and the results obtained are summarized in Table 1.

Certain clinical observations have added data to the problem of ionization which may prove of value in future research. We omit from the discussion the more or less common observations repeatedly published in the literature and shall present several considerations which are regarded as moot in certain quarters.

The first is the color of the nasal mucosa before and after ionization. So far as we were able to determine this factor is so variable that definite conclusions cannot be drawn as to the influence of ionization on the characteristically pale allergic mucosa. It is a fact that in some instances the pale color changes to a pinkish normal with the improvement of nasal symptoms. In others the mucosa retains its pallor in spite of the abatement of symptoms. In still others the color of the mucosa assumes a normal appearance without the patient experiencing any relief from the allergic condition. Certain writers have erroneously attributed a change in color of the mucosa to normal to the effectiveness of ionization in each individual case. Careful study of this phenomenon led to no conclusive findings so that the color of the nasal membrane cannot be accepted as an index of the therapeutic value of ionization. Elaboration on

TABLE 1. — *Summary of 150 Cases of Nasal Allergic Disorders Treated by Zinc Ionization*

	Vasomotor Rhinitis (Perennial Type).	Vasomotor Rhinitis With Seasonal Hay Fever.	Vasomotor Rhinitis With Perennial Asthma.	Vasomotor Rhinitis With Seasonal Hay Fever and Asthma.
No. of cases	72	53	14	11
Diagnostic skin tests previously made	56	44	10	8
Patients in whom one or more skin tests were positive	41	40	7	6
Patients in whom skin tests were negative	15	4	3	2
Patients previously treated by injection without success	50	34	7	8
Nasal surgery previously performed	12	9	2	6
Vasomotor rhinitis improved by ionization	44	31	9	8
Complications improved	....	12	4	4
Vasomotor rhinitis unimproved	....	22	5	3
Complications unimproved	....	41	10	7

color changes of the nasal mucosa would lead us into a study of biochemical influences on nasal allergy, with which we are not concerned at this time.

The indication of surgery in the presence of vasomotor rhinitis has been rigidly restricted by some rhinologists, while others regard the problem as controversial. There seems to be no middle stand. Why a submucous resection should be considered improper when the indication for it is absolute, even though allergic symptoms are present, is difficult to understand. It is quite true that occasionally subsequent to nasal surgery the allergic symptoms subside temporarily, only to recur in a severer degree. On the other hand marked septal obstruction in itself may so interfere with proper ventilation and drainage of the nose and its accessory sinuses as to be important as a contributory etiologic factor, secondary only to the extrinsic cause. With this in mind, eleven patients in whom the indication was absolute and who had been ionized previously without results, were subjected to septal resection. Six weeks were allowed for complete healing when it was noted that seven still suffered from sneezing, rhinorrhea and the other typical symptoms of allergy, although breathing was easier. Six of the seven unimproved patients responded promptly to ionization and have remained symptom free from six months to one year. It is seen that the mechanical condition of the nose has much to do with the effectiveness of ionization therapy and must be properly corrected irrespective of any existing allergy. Prolonged palliation may then be obtained from ionization when without surgical correction it would prove inefficacious.

Improper selection of cases for ionization necessarily leads to indifferent results. The treatment is only mildly effective in the so-called hyperplastic state

which sometimes is confounded with pure vasomotor rhinitis. While the symptoms in the former condition are relieved temporarily, there is no permanent influence on the pathologic process. Ionization is not a substitute for indicated surgery, but may prove of sufficient temporary benefit to justify its use when surgery has to be deferred. We encounter cases of vasomotor rhinitis which are complicated by other affections not easily recognized. Under such conditions one cannot expect ionization to produce as pronounced effects as in true allergic disease, though even in complicated cases a modicum of relief may be anticipated.

Seasonal Hay Fever

Seasonal hay fever may occur alone or as a complication of perennial vasomotor rhinitis. On the other hand numerous cases of perennial vasomotor rhinitis and asthma have been traced back to repeated attacks of seasonal hay fever. The problem of dealing with the seasonal hay fever patient while important from scientific and economic standpoints, is obviously not as great as that of the individual who is incapacitated to some extent the year round. Yet the widespread prevalence of the seasonal condition with its distressing symptoms and the economic loss entailed are sufficient reasons for experimenting with any new procedure.

The enthusiasm with which ionization has been pursued as a remedy for seasonal hay fever seems thoroughly justified even though disappointing results are claimed by some workers. Ramirez's[10] recent report is an example of complete failure which may be explained in part by the criterion which he employed to determine the efficacy of the method, namely, inhalation of pollens to which the patients were sensitive. Symptomatic relief might have been experienced without the intentional provocative testing, and, as a matter of fact, this is precisely the case and accounts for the palliation observed in many instances.

My own experience with ionization in the early fall type of hay fever has been disappointing, but not entirely so. I do not believe that the procedure is curative nor do I contend that its effectiveness is nearly as marked as in the perennial allergic disorders. There are so many factors in connection with the seasonal affection that one must be guarded in reporting the results with any special therapy during a single season. Duke[21] has pointed out that none of the results obtained by ionization in the fall of 1934 should be considered as typical, because during the drouth the pollen content of the air was the lowest since pollen counts have been recorded annually. Duke amplifies this statement: "I may say in passing that as much pollen was deposited on a greased slide in Kansas City, Missouri, in one day in the fall of 1935 (September 15) as would have been deposited during the entire ragweed season in 1934."

The status of ionization therapy in seasonal hay fever should be considered as unsettled. The treatment holds out possibilities of affording patients palliation, but further research will be required before we can accept as final the reports which thus far have been placed on record.

Asthma Associated With Vasomotor Rhinitis

Asthma associated with vasomotor rhinitis is only occasionally benefited by ionization, although usually the nasal symptoms are definitely controlled. When ionization is effective in this type of case, the results are dramatic. The following two illustrative cases show that ionization brought about a surprisingly favorable response after every form of treatment had been employed in vain.

Case 1. — H. T., female, age 45, housewife, had asthma for past twenty-five years, following several annual attacks of seasonal (early fall) hay fever. During the past ten years in addition to the frequent typical paroxysms of asthma, there were present the characteristic symptoms of perennial vasomotor rhinitis. Over 300 diagnostic skin tests had been made. Exclusion of certain foods and injection therapy proved

failures. For seven successive seasons pollen immunization was tried without success. The nose presented the usual vasomotor appearance. Physical examination revealed no systemic factors. The nose was ionized twice on each side, at intervals of one month. This was in June, 1935. Since the first treatment relief of symptoms has been more or less constant, with only a slight tendency to sneezing during the fall hay fever season. There have been no paroxysms of asthma and the patient has gained steadily in general health. As a test of the effectiveness of the treatment the patient made several long automobile trips, one for 1500 miles on dusty roads, without ill effects. During the past winter with the severe cold weather which Chicago experienced, the patient was out a good deal and suffered no respiratory disease. She was free from vasomotor symptoms and there has been no asthma now for nine months.

Case 2. — R. S. T., female, age 36, school teacher, had asthma for fourteen years. Vasomotor symptoms of a perennial character and seasonal hay fever present during the entire period. Diagnostic skin tests yielded no specific findings except for sensitization to ragweed during the hay fever season, but repeated pollen immunization therapy proved a failure. The asthmatic paroxysms occurred several times a day. Physical examination and laboratory tests were negative except for a typical barrel-shaped chest. Ionization was first administered in December, 1934, and repeated once to each nasal chamber one month afterward with prompt and complete relief of all symptoms following the second ionization. Fourteen months have now elapsed without return of the asthmatic paroxysms.

Neither of the two cases is presented with the idea that ionization has produced a cure. Much more time will have to elapse before such a claim would be proper. Nor is it to be overlooked that in many cases of asthma associated with vasomotor rhinitis, ionization has produced no appreciable effect on the asthmatic paroxysms. The dramatic favorable response of ionization after years of exhaustive therapy with every known measure justifies the presentation of the two case reports. They prove that rapid and complete amelioration of symptoms in virtually hopeless cases may take place. For this reason alone ionization should be given a trial when conventional procedures have been ineffective.

Conclusions

1. Zinc ionization of the nasal mucosa has been used as a therapeutic measure for perennial vasomotor rhinitis in comparatively large series of cases with prolonged symptomatic palliation gratifying to both patients and rhinologists.

2. While the results in seasonal hay fever have been disappointing, further research will be required before we can accept as final the reports which thus far have been placed on record.

3. Zinc ionization is a simple and safe procedure in suitable cases of perennial vasomotor rhinitis and in asthma associated with vasomotor rhinitis, and should be given a fair trial when conventional measures have failed.

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Discussion

Dr. Frederick L. Wahrer (Marshalltown, Iowa): I have been familiar with the essayist's work with zinc ionization of the nose for many years. This paper he has given us this afternoon is simply a continuation of his studies and brings them up to date.

The problem of the relief of hay fever is an old one, and I fear that for some years to come it will remain a bothersome problem. That allergic rhinitis is not a local nasal condition has been emphasized by rhinologists. I agree with them fully that the unstable vasomotor condition must be determined before we will accomplish a cure for hay fever.

Zinc ionization is only of occasional value in seasonal hay fever. In my hands, as in Dr. Hollender's, the results have not been satisfactory. I am of the opinion, however, that the method has possibilities as a palliative and that further research should be encouraged.

In perennial vasomotor rhinitis, zinc ionization is of definite value and gives lasting relief. I am not ready to label this treatment as a cure, but certainly its prolonged relief of symptoms approaches the same.

The question of correct technic needs be duly emphasized. Often poor results are attributable not to the method but to the manner in which it is carried out. The procedure must be conducted precisely presupposing on the part of the operator a knowledge of the galvanic current and its medical uses.

Dr. Hollender's remarks concerning McMahon's contention that an early nasopause might be produced by ionization were well taken. When one considers that nasal conditions have been treated with every type of cauterization without a nasopause, McMahon's reasoning seems rather far-fetched.

I am in agreement with the essayist that surgery is not contraindicated by allergic manifestations. The belief that a submucous resection is objectionable in the presence of vasomotor rhinitis, even though the indication is absolute, needs to be changed. I concur in all that has been said on this subject by Dr. Hollender because my experiences have been similar to his. Ionization is more effective when the mechanical condition of the nose is made as perfect as possible.

While ionization is far from a panacea, it has far reaching therapeutic possibilities. Results obtained thus far are certain to encourage investigators not to let up with their studies of this problem.

Dr. C. M. Anderson (Rochester, Minn.): A review of the literature in relation to ionization of the nasal mucous membranes for relief of hay fever, vasomotor rhinitis, and asthma reveals results ranging from nearly perfect to almost complete failure. It would seem that the whole subject is in an experimental stage and that no accurate conclusions can be arrived at as yet. In only rare instances does the author dwell on the reaction of the mucous membranes to treatment or on the immediate effect of such treatment on the patient as a whole.

One is impressed by the severity of the reaction to ionization of the nasal mucous membranes. Many patients describe the

treatment as being much worse than the disease. On a number of occasions patients have said that they were confined to bed for from seven to ten days, and also that the nasal membranes remained irritated for several weeks. In this connection one must of course keep in mind the number of operators who are applying the remedy and the method and skill, or lack of it, used in its application, as well as the personal reaction of certain patients to any given procedure.

Hurd [Arch. Otol. **22**:416 (Oct.) 1935] has published a report recently which is very interesting because of the high percentage of good results obtained and the variety of conditions treated. It appears that he has used various methods, and that he is now flooding the nose with the electrolyte instead of packing it. One objection to flooding is that anosmia results which lasts for some weeks. Hurd concluded: "There is a marked clinical reaction of nasal mucosa lasting about one week. Symptoms of hay fever disappear immediately after ionization in nearly all cases. Patients with hyperesthetic rhinitis are relieved of symptoms in 70 per cent of cases."

Toby [Ann. Otol., Rhin. & Laryng. **44**:94 (March) 1935] was of the opinion that (1) Ionization is efficient for control of hay fever if instituted after the onset of symptoms, but that desensitization should be the method of choice, and (2) that the immediate results in cases of hyperesthetic or vasomotor rhinitis are excellent. The duration of these results is as yet unknown.

House and Gay [J. Allergy 7:86 (Nov.) 1935] reported that 30 per cent of patients with tubal involvement were improved, 40 per cent were not improved, and 30 per cent were worse; that 60 per cent of nonallergic patients were improved, 20 per cent were not improved, and 20 per cent were worse, and that 20 per cent of allergic patients were improved, 47 per cent were not improved, and 33 per cent were worse following treatment by ionization. There was a slight reaction in three of the twenty cases in this series, a moderate reaction lasting three to seven days in ten, and a severe reaction lasting a week or more in seven.

H. L. Alexander stated that: "Successes with asthma, vasomotor rhinitis, migraine, and vernal catarrh have been claimed. Many such patients have been seen and the impression has been gained that ionization did no good. . . . . From this observation it appears that the mechanism of relief from ionization, as well as factors entering into the problem, are yet quite unknown. . . . . From a clinical standpoint it seems an inferior form of treatment for hay fever, asthma and other allergic conditions, with the exception of certain cases of vasomotor rhinitis without established etiology. Here it seems to have a definite place."

H. L. and J. H. Alexander [J. Allergy **6**:240 (March) 1935] found that in twenty-five cases the size of the initial, direct skin reaction did not change materially. Eosinophilia was not changed, and eosinophils persisted in the nasal secretions even of those patients who were benefited by the treatment. Eight of nine patients who did not obtain relief had hay fever, and seven had demonstrable reagins. On the other hand, of eleven patients who were relieved, including five who had hay fever, only three had demonstrable reagins. To summarize, in nine cases there was no relief, in five partial relief, in eleven great relief, in four complete relief, and in two cases great relief after six months.

After considering these reports one cannot escape the conclusion that zinc ionization as a treatment for hay fever and other allergic conditions falls far short of the ideal, and that desensitization, when possible, and avoidance of contact is the treatment of choice. In cases of vasomotor rhinitis the results are better than in those of hay fever, but not much better than those obtained by other types of treatment which produce less severe reactions and require less time and equipment.

At the clinic, chemical cauterization of the sphenopalatine ganglia has produced uniformly good results in more than 50 per cent of cases, the benefits from treatment lasting from three months to more than two years. In this connection one might suggest that if ionization were applied to the region of the ganglia instead of to the whole nasal cavity, it might produce equally good results, with less disturbance to nasal membranes.

In conclusion it appears that all treatments used for this condition up to the present are palliative and symptomatic. The real condition underlying the manifestations: hay fever, vasomotor rhinitis, asthma, and other related diseases, possibly is an unstable or unbalanced vasomotor nervous system. Only after we learn more about the vasomotor nervous system and its control can we hope to approach the treatment of these diseases with any degree of confidence and assurance.

Dr. A. R. Hollender (closing): I want to emphasize that zinc ionization of the nose produces no severe reactions. The procedure can be carried out in the office without premedication and without anesthesia. In our clinic at the University we have treated any number of children from five to twelve years of age. After the treatment they walk out of the clinic without having experienced any severe or harmful effects. There is no sense in making nasal ionization appear more than ordinary office treatment. The plan of hospitalizing the patient and premedicating him is in my opinion altogether unnecessary. It can serve but one purpose. So far as I am concerned ionization should be maintained within the bounds of office methods and office charges.

CONSTIPATION AS A PHYSICAL THERAPEUTIC PROBLEM *

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Constipation is so widely prevalent and so universally "treated" that discussions of the subject evoke little enthusiasm. It is so commonplace that in its treatment, lines of least resistance are usually followed by both the laity and the medical profession. To admit ignorance concerning its nature and control is a reflection upon the intelligence of a medical man, and yet it is so generally misunderstood and so often ignorantly treated that its importance as a measure for discussion is second to none.

Constipation is the result of a disturbed physiologic process, and its correction is based upon restoration of the normal operation of the colon, rectum and anus. The problems involved are largely mechanical and most, if not all, of them can be overcome by the intelligent application of physical therapeutic principles primarily directed toward removal of the barriers that impede nature. Consideration of those barriers and their prevention or removal is our purpose.

Constipation a Problem of Individuality

We often fail to appreciate that in the control of constipation we deal not alone with a disorganized function of the bowel, but with a problem of the individual as a whole. The health needs of the patient must be surveyed at the outset for readjustment is essential as a preliminary to correction of the constipation proper. Dyspeptic complaints must be carefully evaluated, for peptic ulcer, chronic gallbladder disease, and chronic disease of the appendix are definite causative factors. Reactionary opinions to the contrary, removal of focal infections is important. Constitutional diseases, metabolic and endocrine disorders and chronic infections decidedly alter the requirements, but not the principles of therapy. Insufficient food intake and chronic malnutrition are commonly overlooked as sources, for these patients, putting the cart before the horse, as a rule blame their condition on the constipation itself. To expose the sources of their misconceptions and logically adjust their attitude, may lead to restoration of a normal appetite and correction of this abnormality.

It is as essential as much as possible to free the mind of disease as well as the body. One must adopt a sane point of view toward one's self. Ordinarily an introspective individual is constipated, consuming laxatives or addicted to enemas. He is possessed by fears of being poisoned by foods or their putrefactive residue. The task of readjusting such individuals requires no end of tact on the part of the physician and perseverance by the patient. Sources of emotional irritation and annoyance in business, in social intercourse or in the home must be sought out and removed. Physical recreation and mental diversion are essential to a normally toned healthy body which after all is our goal.

Forman has said that constipated people may be divided into two groups — those who give too little thought to the act of defecation, and those who give too much to it. It is, as one may well see, a matter of conditioned reflexes. Tension at the anus controls the tone of the recto-sigmoidal junction, which in turn supports the fecal column and protects the acuity of the defecation reflex by preventing ill-timed and unrecognized rectal overloading. This tonus may be released or increased, and accordingly defecation may be initiated or postponed

* From the Medical Division, Harris Clinic-Hospital.
* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Section on Colonic Therapy, Kansas City, Missouri, September 10, 1935.

by respectively relaxing or tightening the anal sphincter. Spasm of the anus from any cause, therefore, may initiate the train of factors leading to the development of constipation. Neglect results in dulled anal consciousness, while worry, anxiety and excessive tension lead to irritability and spasm. Avoidance of these extremes is an easy matter for the normal individual, but it is a problem of no little concern to him whose nervous system permits nature's call to go unheeded or on the contrary that aggressively thwarts his efforts to relax. Whatever interferes with easy relaxation of the anus encourages the development of constipation. We may then describe the ideal normal state as one of relaxed anal receptivity.

Spastic Constipation

The spastic individual distraught by vexations that put him at great odds cannot be normal. He is over-toned in his skeletal and involuntary muscles alike. Every sphincteric orifice is taut. The colon joins in this spastic parade and barriers to the normal fecal passage appear at the hepatic, splenic or recto-sigmoidal flexures or still more striking at the anus. Expulsion of a normal bolus becomes increasingly more difficult till finally relaxation is impossible. Enslavement to rigid, unnatural and unthinkably restricted diets often ensues. Unbelievable complaints arise. He is carried still further into ill health and invalidism by laxatives that keep the fecal mass soft enough to pass through the abnormally tight and narrowed outlet. The abdomen, sore and tender, becomes a matter of great concern. Liquid and semi-liquid feces containing digestive juices and undigested residues still further irritate the distal colon and furnish rich fields for putrefaction and bacterial growth with abundant opportunity for toxin formation. Such is the picture presented by the great group of spastic neurotics whose complaints are innumerable, due perhaps as often to the driving effects of their laxatives as to their mentally influenced constipation.

Therapy in spastic constipation is well recognized to lie along definite lines of establishing relaxation. To this there is no dispute, and relaxation not only of the colon, but of the entire individual is a *sine qua non* to its attainment. Practice in the art of relaxed anal receptivity is the entering wedge to the success of this therapy. Psychoneurotic disturbances must be adjusted and the individual trained into regular habits. Intraäbdominal and gastrointestinal pathologic conditions and particularly those of the anus must be removed. The diet must be freed from mechanical and chemical irritants. All sources of irritation and spasm must be eliminated and laxatives discountenanced.

The habit of taking laxatives is an error the American public too often commits in the name of health. I have seen patients in great pain and actually punished by themselves for the sake of a laxative they believed a health requirement. It is the heritage of superstition and ignorance perpetuated by unethical and unprincipled advertising manufacturers seeking personal gain. Along with it have sprung up fads and cults of all kinds in dieting and colon therapy, whose popularity is based upon the persuasive slogan, "Keep your colon clean." There is total ignorance among the laity of the fact that nature never intended us to go around with empty colons and that it is the mushy, soupy stool that soils the colon, whereas passage of the formed stool leaves the mucosa quite clean. Measures that result in loose and mushy evacuations therefore defeat the effort to "keep the colon clean." Those of us who use the proctoscope know that a formed stool lies in the rectum and sigmoid without adhering to the mucosa and the impossibility of studying the mucosa when the bowel is filled with mushy or soupy feces. What the constipated person really needs is not so much a softer fecal mass, but a bowel free from barriers to the passage of a normally firm formed bolus.

We read much about "proper hygiene of the colon," but after all what is it? The manufacturer would have us believe it means a daily or at least a regular laxative. Promoters of spas say it is accomplished by the drinking of natural mineral waters. Some diet faddists would have us eat no meat or no sweets, others would eliminate starches or certain vegetables, and still others tell of the dangers of eating more than one kind of food at a meal. Bacteriologists and chemists plead for a change of intestinal flora. Physiotherapists champion their methods of electrotherapy and hydrotherapy, both external and internal. Grandmother says one thing and the doctor another. The poor patient is so confused by it all that he seeks refuge in the first cultist that strikes his fancy, and if he should fortunately happen to be a fellow who is psychologically inclined, the patient gets well.

Atonic Constipation

The most difficult part of this problem is the individual with the atonic decompensated colon. Whatever the causes productive of this decompensation, it most often is an earmark of constitutional inferiority. If the musculature of a part or all of the gastrointestinal tract is inadequate, a part or all of the skeletal muscles share that inadequacy. Too often we forget that the patient with a decompensated colon is an individual who needs measures for the building of general strength as well as for toning up the colon. In such persons the right half and rarely the entire colon or perhaps only the rectum itself may become greatly dilated due to an inadequate musculature, resulting in accumulation of fecal material leading to numerous disabling complaints, abdominal discomfort, various degrees of colicky pain and especially chronic right sided pain. These greatly handicapped individuals form a group of semi-invalids who are more or less slaves to their colons. They anxiously concern themselves with the emptying of their bowels and in the absence of proper advice follow the recommendations of advertisements or the suggestions of relatives or friends. Most of them become laxative devotees.

It is safe to say that whatever part of the colon may be atonic or dilated there is certainly distal to the involved portion a barrier which interferes with normal colon function. This barrier may be only a spasm at one or more of the colonic flexures, but primarily more often at the anus. Contracture of the sphincter ani muscle is common, and not infrequently a heritage from childhood when an over-anxious mother begins the regular use of laxatives under the mistaken notion that they are necessary to good health or because it is the easiest solution to the constipation problem in her baby. In cases with such a background it is the exception to find the anus relaxed and physiologically competent.

The principle upon which therapy in atonic constipation has been built is stimulation of the colon by roughage, inert bulk, electricity, hydrotherapy, massage, exercises, "the controlled use of laxative drugs," and the like. Text books dignify and modern literature prescribes such a stimulating régime. Ingestion of quantities of bulk to fill the colon in order to produce this stimulation is insisted upon. Vegetable roughage and bran are ordered as essentials, and pharmaceutical and dietary houses are spending millions of dollars in the production of cellulose and other expensive, undigestible, bulk producing products of all kinds. And, as if to appease our consciences for adding this greatly increased load to an already weak and over-worked colon musculature, we lubricate it with mineral oil or its emulsion!

I take exception to this time honored method, because it is based upon false premises. It overlooks the fact that the same effect may be obtained by relaxing the anal outlet as from stimulating the musculature above it, and that by reducing the work necessary to evacuation one gets even better results than

from stimulating the bowel to do the added work necessary to overcome abnormal resistance at the anus. I have seen it demonstrated many times to the surprised satisfaction of numerous patients — they recover faster. The cardiologist who would attempt to treat a decompensated heart muscle by a similar stimulating and load-increasing program would not only be doomed to failure, but would be held up to the pity, if not the ridicule, of his confrères. In atonic constipation we deal just as certainly with an inadequate musculature, but gastroenterologists have been slow to recognize this fact. The same principles that apply to treatment of fatigued and decompensated muscles elsewhere in the body should, likewise, apply to the colon.

Rational Management

What is indicated as a rational management is, first, reduction of the amount of work required of the colon, and, second, the strengthening of the muscles that must do this work. It may be accomplished very simply. The resistance offered by the anus and other restraining barriers should be reduced to a minimum. The sensible progressive use of graduated rectal dilators best achieves this, except in the presence of a hypersensitive anus, hemorrhoids, fissure, fibroma or contracture in which case *proper* divulsion under an anesthetic is essential. The diet should be of the low residual type calculated to give the maximum of nutritive value with adequate mineral and vitamin supply and a minimum of residue producing element. Excessive bulk and roughage are rejected not only as non-essentials, but often actually as a handicap. Later on as nutrition improves and compensation returns, the soft residues of fruits and succulent vegetables are gradually increased to meet the increased tonus of the colon musculature. Results will be surprisingly gratifying if these two measures are conscientiously carried out along with habit training in the art of relaxed anal receptivity. The value of physiotherapeutic measures of all kinds would be greatly enhanced, if those using them would observe these basic principles.

After removal of organic barriers voluntary relaxation of the anus is effective especially as the sphincter and levator ani muscles become gradually trained and strengthened from daily exercise in the passage of normal sized stools. The hydrostatic action of a small non-irritating cool water enema at the regular habit time is effective and should be routinely employed during the transition period. One cannot expect the musculature of the colon to be relatively any stronger than the skeletal muscles. A program of general tonic measures with stated rest hours properly balanced against necessary work, calisthenics, out-of-door exercise and relaxing recreation must be regularly carried out. The day's schedule should include a tonic cold bath on arising. Manual massage of the abdomen should be routinely urged. Electrotherapy and colonic irrigations properly administered doubtless have virtues which, however, for economic reasons are not available to a great majority of these unfortunates. The decompensated colon strangely enough is more often than not a part of that oft encountered fatigue syndrome which menaces especially the women handicapped by the responsibilities attendant upon economic stress.

The healthy function of any muscle is maintained by exercise, and since the only exercise available for the sphincters and levators ani is that made possible by defecation, it is essential that this be regular, adequate and affording full range of motion. This can be had only when the stool is firm and full sized. The anus which never accommodates a stool larger than a lead pencil in time adjusts itself to that maximum requirement, and what in the beginning may have been spasm or only disuse finally becomes a contracture. A sphincter ani, therefore, spastic or contracted from disuse over long periods of diarrhea or looseness from habit laxatives precludes the possibility of normal defecation, just as a skeletal muscle long restricted or limited by disuse is not able to accept the

normal range of motion or power. It requires lengthy periods of retraining and supervised physical therapy to restore the normal state.

The stimulus to mass peristalsis and mass movement in the colon is commonly stated to be the eating of food. From personal observation I am convinced it also occurs with the onset of activity each morning on arising and that it can be initiated and increased in frequency by voluntary anal relaxation. This reduces the intrarectal pressure and in turn lifts the rectosigmoidal barrier which permits mass movement of fecal material from the sigmoid and descending colon into the rectum itself, where the defecation reflex is immediately initiated. Maintaining a state of relaxed anal receptivity encourages the conscious perception of the defecation reflex, and once the fecal bolus enters the anal canal mass movement from the sigmoid and rectum continues to complete evacuation unless interrupted by anxious straining or spasm. Thus it may be readily seen that the presence of any irritation at the anal outlet prevents the normal operation of mass movement and the defecation reflex. The correction of constipation tendencies, therefore, requires first of all, removal from the rectum and anus of any interfering pathologic condition.

I have said elsewhere, "The rectum and anus constitute one of the greatest of somatic luxuries, but relatively few have made that discovery." That an organ should take all the punishment which so many give the colon, rectum and anus and that it should yet be amenable to physiologic readjustment is evidence of the virtue of physical therapeutic measures. To accomplish this is not always possible, but its consummation may be expected if we abolish fears regarding the bowel as a source of dangerous intoxication and establish a normal psychoneurotic balance; if we remove all restraining barriers from the colon, particularly from the anus, and establish in the patient's mind the principles of the physiology of defecation; if we eliminate colon overload and build up muscle power in the decompensated colon and regularly emphasize the natural principle of relaxed anal receptivity.

Whether the constipated person be of the spastic or the atonic type, his mere willingness to have a bowel movement does not suffice. A cure comes only by diligent attention to details and the patient, persistent application of the principles here outlined. The old adage that practice makes perfect is superbly applicable, but that practice must be regularly timed. The protracted use even of lubricating laxatives should be discouraged because they serve to keep the idea of the colon's inadequacy uppermost in the patient's mind, and, by creating excessive softness, prevent normal exercise of the muscles of defecation, and promote colon soiling with attendant putrefactive and bacterial multiplication. And whether we employ colon irrigations, electric stimulation, hydrotherapy, massage, psychotherapy or physical therapy, or if we be among those who resort to the "controlled use of laxative drugs," or what not, we should never lose sight of the main fact that if the patient is to be cured of his constipation he must needs have restored physiologic function to the rectum and anus. If this be properly done the colon will uniformly follow suit.

Summary

1. Constipation is the result of physiologic disturbance in the colon, rectum and anus.

2. The problems involved are mechanically operative and center in a series of restraining barriers in the colon, particularly at the anus.

3. Removal of these barriers may be accomplished by attention to the anus along with general tonic measures and mental readjustment.

4. Voluntary relaxation of the anus and exercise of the sphincter and levator ani muscles by daily evacuation of a normal sized fecal bolus is essential to restoration and maintenance of normal colon function.

5. A new principle in the management of atonic constipation is outlined on the same basis as treating a decompensated heart muscle.

6. The normal healthy state is described as one of relaxed anal receptivity.

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ULTRASHORT WAVE THERAPY

W. H. SCHMIDT, M.D.

PHILADELPHIA

Short and ultrashort wave therapy have introduced a new method which is radically different from any heretofore used. Ordinary diathermy currents have a frequency of one to one and one-half million cycles, corresponding to wavelengths of 200 to 300 m., while short and ultrashort waves embrace the wavelengths from 3 to 30 m., corresponding to oscillation frequencies from 100 million down to 10 million cycles per second.

As with all things new, there has been a wave of enthusiasm, which is going to do much harm to this valuable method of treatment. Unfortunately, some manufacturers have seized this opportunity, and there are machines on the market, deficient in output, and with wavelengths, that, to say the least, greatly limit their applicability. Reliable manufacturers regret this, but are forced to meet the competition.

Too many machines are being placed on the market, solely with the idea of being sold at a low price. The physician, with his scant knowledge of the physics of short waves, cannot be expected to know which is the most desirable and it is unfortunate that the manufacturers do not realize that it will ultimately result in great harm to short wave therapy, and alienate many physicians from its use.

To mention only one of many important points: Unless there is an air space of at least an inch between the electrodes and the skin, the so-called edge effect around the electrodes causes a concentration of lines of force, resulting in skin and subcutaneous tissue absorbing most of the energy, and leaving little to penetrate into depth.

Machines, operating with wavelengths of 15 to 30 meters necessitate comparatively large electrodes with thin spacing between them and the body, because otherwise the resulting condenser would be so small that with their comparatively low frequency they could not transmit enough energy into the patient without a great increase in wattage, thus making the cost of the machine excessive. Moreover, with large electrodes a given amount of energy is distributed over such a large amount of tissue that the heating effect per cubic inch is very small. Machines operating at less than 10 meters, arbitrarily called "ultrashort wave machines," are preferable, because their very high frequency makes it possible to use small electrodes, such as are desirable in many treatments and to keep the electrodes sufficiently far away from the skin to avoid excessive skin heat, and insure heat in depth.

Even with this depth effect, all tissue is not heated evenly, because heating of the various tissues depends upon their dielectric absorption, and to some extent upon their conductivity. Thus vascular tissue is heated more than fat, skin or bone, but for any given depth more heat can be transmitted to it by ultrashort waves, than by any other means.

The production of deep heat has been attempted by induction in an electromagnetic field, generated by a coil, in which a high frequency current is flowing. In such a field, materials are heated in proportion to their conductivity. Metals are heated most, while in a condenser field they remain cold. Vascular tissue is heated more than adipose tissue in the electromagnetic field, but the intensity of the heat depends a great deal upon the location of tissue in relation to the coil. Near the circumference of the coil the intensity is greatest, decreasing to zero near the center. In the condenser field tissues

are heated more evenly because the field density can be made practically homogeneous by proper electrode application and spacing. In fact, it is possible in some cases to arrange condenser electrodes so that a greater density of field lines, and thus greater heating is produced in depth than in subcutaneous tissues. With flat electrodes this cannot be accomplished, because in the skin, where the lines of force enter, their density is evidently at least as high as in the deeper tissues which they penetrate. However, when belt electrodes are employed, around a leg for instance, the force lines have a tendency to bunch up at depth, because they must all run from one belt to the other, and they do so roughly in flattened half-circles.

The manner in which the electric energy is distributed in the tissues differs considerably with the frequencies employed according to the laws clearly established in high frequency physics. The blood, flushing the tissues, though affecting the results which may be predicted from those laws, does not change them materially, and familiarity with these laws is therefore desirable for anyone who wishes to practice short wave therapy intelligently.

In long wave diathermy the heat is produced in the tissue in proportion to the resistance offered to the passage of the current, so-called ohmic resistance. A current of electricity is actually flowing, which takes the path of least resistance, so that the heating is unequal. After the passage of considerable time the increased circulation distributes the heat so that the part is more uniformly heated throughout.

In short wave therapy the electrodes are separated from the tissues by a non-conducting material, so that no current can flow in the sense of diathermy. In the condenser field between the electrodes the tissues are heated, due to their inability to undergo the rapid change of direction and intensity of the electric charge. Any non-conductor, except air, will heat up in a condenser field, due to these "dielectric losses." In human tissue which is more or less conductive we have a combination of ohmic losses as a result of currents flowing, and of dielectric losses as a result of the electric field effect, and a more rapid heating takes place than in non-conductors. Deeper and more uniform heating is produced and the time of treatment is much less than in diathermy. By use of suitable electrodes we are able to concentrate our heat effects more accurately over the local pathologic process.

We can compare diathermy and ultrashort wave to ultraviolet and x-ray. They have widely different frequencies. The ultraviolet is superficial in effect while the x-ray penetrates and affects the deeper structures.

In a condenser field different substances heat up unevenly, due to differences in their ability to absorb electric energy, and the same is true of living tissue. The shorter the wavelength the greater is the dielectric loss and the less pronounced the ohmic loss. The best heating efficiency is obtained where each represents about 50 per cent. Experience shows that wavelengths in the neighborhood of 10 m. give the best heating effects, shorter or longer waves requiring more energy for the same amount of heat production.

As pointed out before, to obtain a fairly homogeneous field and thereby as much deep heat as possible, the electrodes must be separated from the skin by an inch or a half inch of air or felt. If the electrodes are in contact or if rubber is used as spacing, the effect is more superficial. After properly placing the electrodes, the machine must be "tuned" to obtain the best input. Tuning, as in radio reception, simply means adjusting the capacity or inductance in the patient's circuit, so that its oscillation frequency is equal to that of the machine circuit, bringing the two circuits into "resonance."

Only a comfortable sense of warmth should be felt, and patients used to taking diathermy, with its greater heating effects on the surface, will

frequently insist that they are not getting enough current and lead the technician to increase the output to a dangerous point. Excessive heat is manifest as pain and must be avoided, as blisters may occur in such cases. The machine must be watched by someone close at hand so that he can immediately readjust the output.

Much mention is made of the lessened danger of burns. We have seen some burns since using short wave as we did with diathermy, no doubt due to insufficient familiarity with the technic. Small blisters may occur and in one case, there was a sloughing of the superficial skin. Another case, seen in consultation and treated elsewhere, showed a subcutaneous infiltration, due to over-dosage, which was undoubtedly a thermic effect on the subcutaneous tissue due to excessive heat. With experience, all these faults have been eliminated, but the danger is ever present, and our only safety is a proper understanding of the source of energy with which we are dealing. Between the wire leads to the electrodes an active field exists, just as between the electrodes themselves, and burns may result unless contacts between leads and patient are carefully avoided. Similarly, if the wire leads are permitted to touch each other, the energy is short circuited and the electrodes become more or less inactive, and sufficient heat may develop where the leads touch to burn through the insulation, just as this may happen in a diathermy treatment if the leads are not properly fastened and sparks cross either between them or to the patient.

While it is unlikely that short wave therapy will supplant diathermy, it is applicable in most of the conditions for which we now use long wave diathermy. The most striking effectiveness of short wave therapy is in acute infections, and as conventional diathermy is contraindicated, we have in it a valuable addition to our armamentarium.

Schliephake, who has had a large experience with this form of therapy, reports: "I have treated many hundreds of cases of furuncles, even large carbuncles, on every possible part of the body, and I am able to state that ultrashort wave therapy has not failed in a single case." This is a very sweeping statement and needs confirmation, but even with the little experience we have had, it has become evident that it contains considerable truth. Our observation of these conditions has shown a change after one or two treatments. The most remarkable feature is the prompt relief of pain that occurs in virtually every case.

Clinical Observations

Case 1. — A man, age 35, with a well developed carbuncle of the neck, about 3 inches in diameter. He had intense pain, induration of entire neck, and rise of temperature. First treatment, given on a Monday. Following the second treatment the pain was completely gone. There were three or four minute openings discharging pus. Thursday, about ten openings were present and the carbuncle discharged freely. In the meantime, the induration of the neck had diminished, and the tissue become soft. By Saturday, the pus was entirely drained and in two or three days more, the opening healed. Treatments were given daily for ten minutes. Since that time, we have had fourteen other cases of carbuncle, all of which made a rapid recovery, without surgery and with prompt relief of pain.

Case 2. — An infected human bite on the hand. There was great swelling, pain, and a discharge of pus. Following the second treatment, there was a marked relief of pain and in seven days, the hand had returned to normal.

Case 3. — A woman with a seriously infected terminal phalanx of the index finger. Duration: seven days, had been opened four times. There was no relief of symptoms and the pain was excessive. Short wave therapy was given for 15 minutes, and the patient experienced complete relief of pain in two hours.

Case 4. — A large abscess on the thigh of a rather obese woman was treated and opened spontaneously in two days, with complete and rapid healing.

CASE 5. — A child, five years old, with double empyema. The physical condition was very poor. No operation was done except that pus was aspirated with a needle. Thirty-six treatments in all were given, with complete recovery. The pus cleared up quite rapidly and I do not believe it was really necessary to give so many treatments.

Several cases of lung abscess of the chronic type have been materially helped, but we did not have an opportunity to follow them through to completion.

We have also treated one hundred other cases of infections of minor nature, in whom the results have been most satisfactory.

Osteomyelitis is also markedly benefited. While we have treated a number of cases, we cannot report any definite results, until we have had a longer period of observation. We can, however, report our observation of the first effects of treatments. Prompt disappearance of pain was noticed in virtually every case. It was observed that small pieces of dead bone sequestrated very promptly and were discharged. One case of osteomyelitis of the tibia was treated immediately after operation. Pain disappeared promptly and the condition healed rapidly and apparently completely. Of course, it remains to be seen whether there will be any future recurrence. A case of osteomyelitis of the ilium and one of the scapula came to operation after a few treatments. In these deep-seated cases surgical drainage is essential, but short wave treatment will augment healing.

Another condition in which we have had encouraging results is sinus infection. Several acute cases showed prompt relief of pain and disappearance of symptoms. Several chronic cases are under treatment and all reported relief of pain, lessening of discharge and abatement of the pressure symptoms. One case was of particular interest, as the patient had had six operations on the nose, in which the ethmoids had been removed, a radical antrum operation performed on both sides, and one operation on the frontals. There was persistent discharge with crusting and frequent attacks of pain. Ten treatments of short wave were given, during which time the patient was under the observation of a rhinologist, who reported a rapid diminution of discharge and crusting, and a more healthy appearance of the mucous membrane. The pain and discomfort disappeared after the third treatment.

Some forms of arthritis respond better to this therapy than to ordinary diathermy. A rather advanced case of arthritis deformans was given 14 treatments, with complete disappearance of pain, and marked improvement in motion. Only a slight stiffness remained. Another case, showing involvement of multiple joints, all of which were treated individually, showed marked improvement after 20 treatments.

One of the effects claimed for ultrashort wave therapy is that there is a lasting dilatation of the capillaries. Some experiments have been carried out, which would seem to substantiate this claim. It is well known that in arthritis there is a diminution of blood supply, a lowered temperature and spasticity of the capillaries. It is conceivable, therefore, that the dilatation of the capillaries by short wave tends to overcome the pathologic process of arthritis and be a rational therapy.

A similar condition exists in certain vascular diseases, such as Buerger's, and Reynaud's disease, and with the effect of short wave on capillaries in mind we have tried it in several cases. One case of Buerger's disease, of seven years' duration, has had periodic treatments of several months with marked improvement. The circulation is better, and there has developed no new areas of necrosis. The patient is required to be on his feet much of the time, and he finds he is scarcely encumbered, where formerly he was almost complete incapacitated.

Diabetic gangrene is another condition which we have treated, and in which we have seen beneficial results.

A very advanced case of tubercular laryngitis showed a very remarkable improvement after a series of treatments. The pain and soreness disappeared, swelling was decreased and the voice much better. Inspection showed a marked change of the larynx towards normal. Unfortunately we were not able to follow the case for a sufficient time for an external reason.

Conclusion

Short wave therapy has opened a new field, which holds out great promise for future medicine, particularly in acute infections of all types, for which ordinary diathermy is contraindicated. Much work remains to be done to further clarify the situation and establish its real value. We are too prone to look for specific effects, as for example on bacteria, ignoring the fact that the increased circulation brings healing to affected parts. It should be realized that this therapy requires more, and not less, attention to the technic than does conventional diathermy. Study of the physical foundation of short wave therapy will bring about fewer failures, and the whole therapy will be placed upon a better foundation.

805 Medical Arts Bldg.

COUNCIL ON PHYSICAL THERAPY

Tenth Anniversary

HOWARD A. CARTER, B.S. in M.E.

Secretary Council on Physical Therapy, American Medical Association

CHICAGO

For a decade the Council on Physical Therapy of the American Medical Association has been actively engaged in critical analysis of physical therapeutic methods and in reporting its findings. Although the Council was created in 1925 by a resolution of the House of Delegates, it did not begin to function until 1926. Before the World War, the term "physiotherapy," like its practice, was generally misunderstood and was looked upon with skepticism by the majority of physicians. Successful employment of physical therapeutic methods in the rehabilitation of wounded soldiers at the close of the World War brought its value forcibly to the attention of the profession. Those physicians who were actively engaged in the rehabilitation of the wounded soldier became supporters of physical therapy, while those not having had such experience were not easily convinced of its merits.

Although many critical articles were published evaluating physical therapy, apparently the most active popularization of it ten years ago was accomplished by representatives of manufacturers through direct contact with physicians. Naturally, machine therapy was stressed at the expense of other methods, such as the application of heat, massage, and exercise; and many physicians came to believe that mere possession of a diathermy apparatus and an ultraviolet lamp qualified them to practice physical therapy. Some proponents of apparatus sent physicians of questionable repute throughout the country to conduct clinics. Investigating them, the Council learned, in many instances, that a large portion of the so-called instruction was devoted to demonstrating and selling machines, while little time was

allotted to instruction. Apparently the profession did not have the opportunity to learn that true physical therapy consists chiefly of intelligent application of heat, massage, and exercise; and that machines and apparatus, although valuable in their place, play a relatively minor part. Therefore, the confusion caused by the contradictory statements in the promotional activities for machines and apparatus was one reason the House of Delegates voted to establish the Council on Physical Therapy.

There has been a steady growth of acceptance of physical therapeutic measures by the general practitioner since the Council was established. The activities of the American Congress on Physical Therapy, the Council, and other groups interested in the field, have contributed to the expansion. Specialists in physical therapy have prepared articles, some of which have been adopted by the Council and published in *The Journal of the American Medical Association*. A large portion of these special articles has been incorporated in the *Handbook of Physical Therapy*. This handbook has recently undergone revision and its second edition is now available. The Council is of the opinion that a large number of general practitioners have obtained a narrow point of view concerning the value of physical therapy through contact with representatives of manufacturers who stress the importance of machines. In the Handbook, therefore, one will find discussions of the therapeutic uses of heat, massage, exercise, medical and surgical diathermy, ultraviolet and infrared radiation, roentgen rays, hydrotherapy, and colonic therapy. The Council hopes the profession will not lose sight of the broader aspects of physical therapy, for much can be accomplished by simple methods and intelligent management.

Educational activities sponsored by the Council fall into two divisions: premedical and postgraduate. It is gratifying to observe that physical therapy is taught in all Class A medical schools, although special reference may not be made to it in the curricula. In one school it may be taught in the orthopedic department, in another in the roentgen ray department and in still another in the surgical department. Some schools teach physical therapy methods in all departments of medicine. The Council believes that physical therapy should not be made a specialty in medicine, as for example ophthalmology or pediatrics.

Extension instruction in physical therapy for the practitioner is ardently encouraged by the Council. Postgraduate courses are now available in several medical schools for those who wish additional training. Emphasis is placed on the instruction sponsored by medical societies. In certain centers, courses of one to two weeks duration have been tried with gratifying results. Reserving an entire evening of a regular medical society session has also been successful in other sections. Cooperating with its group of consultants on education, the Council is able to suggest qualified speakers on physical therapy subjects of general interest. Names of speakers in various localities may be obtained by writing to the Secretary at headquarters. Films on physical therapy subjects are available and are loaned to societies, the only expense being the return mailing.

Training courses for physical therapy and occupational therapy technicians have been given consideration by the Council. In 1930 the Council suggested a curriculum which was adopted and published in *The Journal of the American Medical Association*. Since then, the Council on Medical Education and Hospitals has taken over the investigation of technicians' schools for both physical therapy and occupational therapy instruction. Requirements and standards for occupational therapy courses have been adopted, while the investigation of physical therapy courses has been progressing satisfactorily and will be completed soon.

The first two or three years of the Council's existence were devoted to

self-education of its members; to formulating rules of procedure for conducting its business; to studying certain physical phenomena used in physical therapy; and to preparing official rules and requirements for the consideration of apparatus. Minimum standards for the acceptance of ultraviolet generators, sunlamps, diathermy apparatus, shoes, and surgical belts, have been prepared and adopted. Cooperating with physicists, engineers and physicians, a list of definitions and nomenclature has been adopted and published. Since its inception, the Council has considered 356 pieces of apparatus, of which 191 have been accepted and 22 rejected. One hundred and forty-three devices are still under consideration. Of this latter group, a large number have been investigated and rejected; but when the reports were sent to the respective manufacturers, in many instances they requested that the reports be held in abeyance pending further consideration. In some cases the objectional apparatus has been withdrawn from the market. More than one hundred mechanical nostrums have been refused consideration, since they obviously revealed no therapeutic efficacy.

Although a meeting is held once a year at headquarters, the major portion of the business of the Council is conducted by means of a fortnightly bulletin. In this bulletin the reports of investigators of apparatus are recorded, advertising matter reviewed, and abstracts of the reports included for comment, criticism and vote, all of which requires several hours of study. The Council has considered resuscitating apparatus, positive and negative pressure apparatus, infrared and ultraviolet generators, orthopedic appliances, radium and radon products, roentgen ray equipment, exercising machines, hearing aids, audiometers, surgical supports, electric blankets, lenses and ophthalmological devices, anesthesia and oxygen equipment, metabolism testing instruments, and medical and surgical diathermy equipment. In the consideration of ophthalmologic devices, the Council has cooperated with the Committee on Standardization of Instruments and Drugs of the Section on Ophthalmology of the American Medical Association.

The Council on Physical Therapy consists of twelve men: one internist, two physiologists, one pathologist, one physicist, one radiologist, one dermatologist, two orthopedic surgeons, one general surgeon, and two physical therapists. The present membership of the Council is as follows: Doctors W. W. Coblentz, Washington, D. C.; John S. Coulter, Chicago, Illinois; A. U. Desjardins, Rochester, Minnesota; F. J. Gaenslen, Milwaukee, Wisconsin; W. E. Garrey, Nashville, Tennessee; H. T. Karsner, Cleveland, Ohio; F. H. Krusen, Rochester, Minnesota; G. M. MacKee, New York, N. Y.; H. E. Mock, Chicago, Illinois; R. B. Osgood, Boston, Massachusetts; Ralph H. Pemberton, Philadelphia, Pennsylvania; H. B. Williams, New York, N. Y. Doctors Morris Fishbein and Olin West, Chicago, are ex officio members.

The members receive no compensation, and the profession owes much to them because of the large amount of work entailed to which they give much time and untiring effort.

ATTEND THE SPRING SESSION

Eastern Section

AMERICAN CONGRESS OF PHYSICAL THERAPY

MAY 27, 28, 1936 — PHILADELPHIA

Philadelphia County Medical Building **21st and Spruce Streets**

EVENING SESSION, May 27, JOINTLY WITH PHILADELPHIA COUNTY MEDICAL SOCIETY

Morning Session

WEDNESDAY, MAY 27, 10:00 A. M.

Philadelphia County Medical Building

WILLIAM H. SCHMIDT, M.D., Presiding.

1. **Address of Welcome — William Bierman, M. D., President-Elect, American Congress of Physical Therapy**

2. **Physical Therapy in the Treatment of Arthritis**
JOHN de P. CURRENCE, M.D., Instructor in Medicine, Columbia University New York Post-Graduate Medical School, New York.
Discussion: Ralph Pemberton, M.D., Philadelphia; Abraham Cohen, M.D., Philadelphia.

3. **Physical Therapy in Orthopedic Conditions**
JEROME WEISS, M.D., Attending Physical Therapist, Hospital for Joint Diseases, New York, Brooklyn, N. Y.
Discussion: James Martin, M.D., Philadelphia; Howard Moore, M.D., Philadelphia.

4. **Danger of Over Treatment in Physical Therapy**
MADGE C. L. McGUINNESS, M.D., Instructor in Surgery, College of Physicians and Surgeons, Columbia University, New York.
Discussion: Heinrich Wolf, M.D., New York; William T. Johnson, M.D., Philadelphia.

LUNCHEON

Afternoon Session

WESNESDAY, MAY 27, 2:00 P. M.

Philadelphia County Medical Building

JOHN de P. CURRENCE, M.D., Presiding

5. **Temperature of the Surface of the Skin**
WILLIAM BIERMAN, M.D., Attending Physical Therapist, Mount Sinai Hospital, Assistant Clinical Professor in Therapeutics (in charge of the Department of Physical Therapy), New York University Medical School, New York.
Discussion will be opened by David W. Kramer, M.D., Philadelphia.

6. **Fever Therapy in Office Practice**
G. J. P. BARGER, M.D., Washington, D. C.
Discussion will be opened by William H. Schmidt, M.D., Philadelphia.

7. **Treatment of Erysipelas with Ultraviolet Energy**
NORMAN E. TITUS, M.D., Formerly Director Department of Physical Therapy, Columbia University, New York.
Discussion: Truman Schnabel, M.D., Philadelphia; Maurice Weisblum, M.D., Philadelphia.

DINNER — 6:30 P. M.
RITTENHOUSE HOTEL

Evening Session

WEDNESDAY, MAY 27, 8:00 P. M.

JOINT MEETING WITH PHILADELPHIA COUNTY MEDICAL SOCIETY

Philadelphia County Medical Building

G. C. YEAGER, M.D., President, Philadelphia County Medical Society.
WILLIAM H. SCHMIDT, M.D., Chairman, Eastern Section, American Congress of Physical Therapy.
} Presiding

8. **Evaluation of Suction Pressure in Peripheral Vascular Disease**
EUGENE M. LANDIS, M.D., Research Associate in Pharmacology, and Assistant Professor of Medicine, University of Pennsylvania,
and
LEWIS H. HITZROT, M.D., Associate in Medicine, University of Pennsylvania, Philadelphia.
Discussion: David W. Kramer, M.D., Philadelphia; Meyer Naide, M.D., Philadelphia.

9. **Influence of Short Wave Radiation on Constituents of the Blood**
DISRAELI KOBAK, M.D., Assistant Clinical Professor of Medicine (Physical Therapy), Rush Medical College of the University of Chicago, Chicago.
Discussion: William Bierman, M.D., New York; Norman E. Titus, M.D., New York.

THURSDAY, MAY 28

CLINICS

Physical Therapy Department of Jefferson Hospital, 1015 Walnut Street, Philadelphia

9:00 **A Demonstration of the New Treatment for Ticdouloureaux**
BENJAMIN ULANSKI, M.D., Philadelphia.

9:45 **Value of Suction Pressure in Peripheral Vascular Disease; Demonstration**
ROBERT STURR, M.D., Philadelphia.

10:30 **Treatment of Sinus Infection with Short Wave Diathermy**
THOMAS LEICHNER, M.D., Philadelphia.

11:15 **Evaluation of Fever Therapy; Demonstration**
WILLIAM H. SCHMIDT, M.D., Philadelphia.

1:00 **Glycocol Mecholyl Iontophoresis in the Treatment of Muscular Dystrophy**
A. A. MARTUCCI, M.D., Philadelphia.

1:45 **Zinc Ionization in Nose and Ear Conditions**
PHILIP STOUT, M.D., Philadelphia.

2:30 **Treatment of Paralytic Ileus by Galvanism**
FREDERICK COCHRAN, M.D., Philadelphia.

3:15 **Value of Static Currents in Bell's Palsy**
WILLIAM T. JOHNSON, M.D., Philadelphia.

4:00 **Exercise and Massage as a Therapeutic Agent**
JOSEF B. NYLIN, M.D., Philadelphia.

Physicians, their technicians, and medical students cordially welcome. Write for program.

William H. Schmidt, M.D., Chairman,
Medical Arts Building, Philadelphia, Pa.

Norman E. Titus, M.D., Secretary,
730 Fifth Avenue New York, N. Y.

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EDITORIALS

INFLUENCE OF ULTRAVIOLET ON BLOOD PRESSURE

Although variations in blood pressure do not in themselves constitute a disease, the damage and danger arising from permanent hypertensive vascular changes are no less a challenge for therapeutic intervention than if they were considered one of the important human affections. No other symptom has been more publicized in the lay press nor received more serious consideration by the profession. It is exactly one hundred years ago that Bright discovered the association of cardiac hypertrophy with certain types of renal disturbances. Later contributors to this particular problem were Johnson who, in 1856, demonstrated hypertrophy of the muscular layer of the arterioles as an index of increased labor; v. Basch who, in 1876, adapted the sphygmomanometer for clinical interpretation; Albutt who, in 1895, was the first to clearly differentiate primary hypertension from that of renal origin and coined the term "hyperpiesia"; and Janeway who, in 1912, clarified the causes of death by and the prognosis of high blood pressure. Thus the past century has contributed important information on the subject which has served as a stimulus for a more aggressive attitude by the profession, aggressive in the sense that it has since attempted critically to evaluate and coordinate every measure, medicinal and physical, that promised amelioration of the symptoms. Efforts have also been made to control the causative factors of the pathologic changes in the circulatory system and the constituents of the blood.

The literature on our therapeutic interventions is replete with setbacks and is a record of the rise and fall of many promising measures that eventually passed into the limbo of lost hope. These failures, however, are far from being a total loss, for they have served to stimulate research which has brought definite knowledge of the underlying histopathology. Valuable as this knowledge is, it has not been entirely adequate for the solution of the clinical problems. Critical study and actual experience have shown that there is no specific remedy for primary

hypertension. It is a symptom based on and involving many complex factors, not excepting heredity and environment. Reisman aptly has designated this condition as a disease of the American, implying that it is due to the stress and strain of modern civilization, which is an important factor in the development of permanent changes in vascular tension.

It needs no stressing that physicians are still concerned with the relief of symptoms, and that any therapeutic intervention which empirically or otherwise holds out a promise of amelioration of the major and secondary symptoms, will receive earnest consideration. It is realized that because of the protean character of this manifestation one hardly can expect a new treatment of the nature of a *sterilizatio magna*, that is to say, one that will compensate for the energy reduction of the heart, the peripheral resistance and resilience in the arterial walls, as well as lower the blood pressure. Yet in the light of past and present experience it is not unreasonable to hope that a new therapeutic approach will be found that will refute the pessimism of some of our leaders who have developed a nihilistic attitude with regard to the solution of this serious problem. Most authorities are in accord with Sir Thomas Lewis[1] that "there is no known method of lowering pressure materially and over long periods of time," and that "the most effective treatment is a suitably restful régime."

While it is true that physical therapy in the form of rest, hydriatic and thermal measures has provided appreciable relief of symptoms and even reduction of vascular tension, it is interesting to learn that today ultraviolet radiation holds out a more promising approach to the clinical control of high blood pressure. Experimental and clinical studies by Laurens,[2] published elsewhere in this issue, reaffirm the much neglected and forgotten experimental evidence by Hasselbalch, who, in 1905, first called attention to the value of carbon arc radiation in hypertensive and anginal conditions. Hasselbalch[3] emphasized that this form of radiation resulted in prolonged overfilling of the cutaneous vessels with blood, that irradiation with high ampere arcs produced a lowering of blood pressure simultaneous with and long sustained after the creation of the initial skin erythema. It was then believed that the cutaneous hyperemia brought about mechanical relief of the heart and large blood vessels. Laurens undertook experimental studies on two groups with and without vascular tensive changes, as a result of which we no have a broader orientation of the effect of this type of irradiation. The hypertensive group was studied under ambulatory conditions in order to eliminate rest as a possible factor of any changes. According to Laurens the most striking effect noted in both groups was an increase in the cardiac output after irradiation. Whether this was due to compensatory effects of the radiation or to other factors is difficult to determine. Oxygen consumption showed insignificant changes, the pulse was fuller and stronger, and the hemoglobin was lower with an increase of the blood volume after radiation. The average systolic and diastolic drop in the hypertensive group was 17 mm. Hg. and 7 mm. Hg., respectively.

The fact that ultraviolet radiation brings about long sustained reduction of blood pressure has given rise to many theories to explain its effect. Of these the concept is most plausible that the diminution of the viscosity of the blood plays as important a rôle as the cutaneous hyperemia. Whether the total effect is obtained by depressor substances activated in the skin, or by the inhalation of oxides of nitrogen (the so-called ozone phenomenon) from the lamp, or through the liberation of substances with histamine-like properties resulting in increased dilatation and permeability of the blood vessels, must be determined by further studies. For the present we must remain content that a fact of great clinical importance has already been added to medicine.

References

1. Lewis, Sir Thomas: Diseases of the Heart, New York, The Macmillan Company, 1933.
2. Laurens, Henry: Effect of Carbon Arc Radiation on Blood Pressure and Cardiac Output, Arch. Phys. Therap., X-Ray, Rad. 17:199 (April) 1936.
3. Hasselbalch, K. A.: Die Wirkungen des Chemischen Licht Bades auf Respiration und Blutdruch, Skand. Arch. f. Physiol 17:431, 1905.

THE SOUTHERN SECTIONAL MEETING

The first meeting of the Southern Section of the American Congress of Physical Therapy was held on March 23 and 24 at New Orleans, Louisiana. The scientific program was presented the first day in the auditorium of Tulane University School of Medicine. Clinics were conducted on the morning of the second day at Touro Infirmary under the auspices of the Graduate School of Tulane, and in the afternoon at the Charity Hospital under the auspices of Louisiana State University. The evening session of the first day was held jointly with the Orleans Paris Medical Society.

The meeting was well attended, and from the tone of discussions it was obvious that the audience was more than passively enthusiastic. While physical therapy is by no means an innovation in the South, this was probably the initial effort to hold an exclusive physical therapy gathering in that part of the country. Representatives from the two local medical schools and from leading hospitals of the city demonstrated by their addresses and clinics that New Orleans is a progressive medical center, keeping stride with the work which is being carried on in medical institutions of other metropolitan cities.

The scientific program was varied and highly informative. Papers were read on subjects of interest to specialists and general practitioners. Several valuable reports on recent researches were presented and as these are published in the ARCHIVES they will doubtless add to the wealth of material which is constantly being offered the profession. The symposium on fever therapy proved that this procedure may be far reaching in its scope and that as time goes on further advances may be made. Such subjects as arthritis, prostatic resection and short wave which occupied the joint evening meeting rounded out a well balanced scientific program. Mr. Howard A. Carter, secretary of the Council of Physical Therapy, gave a demonstration on the mechanics of short wave which was highly instructive.

On March 24, the morning clinics at Touro showed the fine spirit of cooperation which prevailed in an effort to make the visit to New Orleans a profitable one. Staff members from several departments reported on research which was being conducted in the institution, while guest speakers from other institutions contributed in no small measure to a worth-while clinical conference.

In the afternoon of the same day the conference moved to Charity Hospital where faculty members from Louisiana State and guests participated in conducting demonstrations and clinics. Fever therapy, passive vascular exercise, neoplastic disease, nasal ionization and several other timely subjects were discussed at length.

The Congress tendered a luncheon to visiting physicians and in the evening a dinner was given which was attended by a large group. The hospitality of the South was constantly in evidence. The cooperation of the New Orleans Association of Commerce, the willing direction and help of Dr. Nathan H. Polmer of Tulane and Dr. Upton Giles of Louisiana State were indispensable in making the first meeting of the Southern Section a notable success.

GROWING INTEREST IN PHYSICAL THERAPY

From time to time the question of general interest by the medical profession in physical therapy has been raised and answered. To those that have taken an active interest in our discipline it has been evident for some time that physical therapy has gained many followers among clinicians of repute. Just the same it is gratifying to be in a position to add another proof by general recognition by the most important national medical publication.

The issue of the *Journal of the American Medical Association* for April 4, 1936, presents striking proof of the interest of physicians as a body in the subject of physical therapy. The first article by Meyerding on Volkmann's ischemic contracture advocates the use of physical therapy. "In every case of ischemic contracture, whether operation is performed or not, it is my opinion that physical therapy is the greatest aid in recovery of a useful extremity. . . . The surgeon should also remember that without careful postoperative care and prolonged and intelligent physical therapy he can accomplish little."

The fourth article in the same issue deals with passive vascular exercise, which is purely a physical method of treatment, and with the results obtained in the surgical and physical therapy departments of the New York Hospital. The sixth article by Bierman, Director of Physical Therapy of the Mount Sinai Hospital, deals with a study of skin surface temperatures and, among other things, the effect of various physical therapeutic measures upon the surface temperature.

Among the reports of officers of the American Medical Association we find on page 1174 a voluminous report by the Council on Physical Therapy describing its activities, while on page 1198 the Council on Medical Education reports its study of schools for the training of physical therapy technicians.

On page 1208 appears an announcement of Coulter's talk on "Physical Therapy in the Treatment of Chronic Arthritis," while on page 1210 there were announcements of talks on "Fever Therapy," by Bierman and by Simpson. On page 1211 appears an announcement of a talk by Egan on "Ultra Short Wave Therapy," and on page 1226 a review of a book on electropyrexia by Hinsie and Blalock. Page 1226 brings a description of a new physical method of treating acne vulgaris by suction.

Council approved devices, too, were published in this issue. A full page announcement of a new edition of the *Handbook of Physical Therapy* appears on page 40. An announcement of a postgraduate course in physical therapy is found on page 41, and various sanitoria advertise their use of physical therapy on pages 42 and 43.

References to the subject of physical therapy were made in no less than twenty-eight of the 147 pages of the issue and the term "physical therapy" appeared in the text seventy-nine different times in articles, announcements, reports, notices of meetings, advertisements, and the like. In our opinion this single issue of the *Journal* presents in a pleasing manner the fact that physicians are becoming enormously interested in problems of physical therapy.

THE KEEP FIT MOVEMENT

To increase and maintain physical efficiency, which it is needless to say is a great aid to maintaining a healthy active mind, is the slogan today of all nations in the van of progress. The Germans, the Scandinavians, the Japanese, Italians, and the inhabitants of this continent recognize that if a country is to retain its position, its population must be fit in body and mind and efforts are being put forth with this end in view.

Germany, in particular, is making a cult, almost a religion, of bodily efficiency, and the same, to a lesser extent, may be said of Japan. Germany and the Scandinavian countries for a long time have practiced gymnastics and excel in these forms of physical exercise. Italy, too, and the Balkan countries come in much the same category. Indeed, all nations in some degree have become alive to the fact that the proper care of the body is one of the greatest assets to the individual and the community at large. In Europe generally, outside of Britain, muscle building has been the first consideration. In this country and in Britain games have had the greater vogue by far. However, as far as Europe including Britain is concerned, a different point of view is being exhibited and put into practice.

On the continent of Europe games of British origin have become exceedingly popular. It is superfluous to state that lawn tennis flourishes everywhere while association football is a good second. On the other hand, in Britain although games retain fully their popularity, organized physical training is raising its head in all parts of the land. Perhaps the most significant feature of this comparatively new departure is that the British women are among the most enthusiastic supporters of the "keep fit movement." This is a good augury for its success and continuation. Physical training has lagged in Britain where the devotion to the traditional games, played by the few and not the many, has been ever in evidence. It is not only the young of the country who are going into training but older people of both sexes.

In America and Canada games preponderate and the same drawback as in Britain may be urged against the way they are conducted. As a rule, comparatively few play, and games are looked upon as spectacles "run" mainly for the sake of gain. Certainly in our colleges physical training plays a considerable part in the scheme of education and it seems that it should be developed from one end to the other of the country. The mode of physical education should be elastic, no one method being followed slavishly, but should be adapted to age, sex, climate, physical characteristics and temperament. Such training employed judiciously, and this is an important point, tends to good health and its conservation. Perhaps it is the safest and surest road to absolute good health if there be such a state. And if so, as prevention is better than cure, so must this ideal state of health be better than prevention. However, it might be unwise to be too optimistic regarding the efficacy of physical education, so that it will be enough to say that if education of this kind proves itself to be an efficacious means of preventing a great deal of disease then it will have served its purpose amply. — Medical Record **143**:270 (Apr. 1) 1936.

FELLOWSHIP IN PHYSICAL THERAPY AT STANFORD UNIVERSITY

On December 8, 1935, the Council on Physical Therapy of the American Medical Association finally approved a residency in physical therapy at Stanford University Hospitals, under the direction of Dr. H. L. Langnecker. This is the first residency in physical therapy to be approved and thus the Council recognizes a new classification for postgraduate residency training for physicians. This action has already stimulated similar steps being taken to establish residencies in other institutions. The American Congress of Physical Therapy has been a pioneer in its efforts to promote scientific physical therapy, and this task which has been frought with difficulties will continue to be its first aim. We commend the progressive program of Dean Roscoe Chandler who has long been known for his educational activities in medicine.

SCIENCE, NEWS, COMMENTS

Dr. Roy Fouts Honored

The announcement of the election of Dr. Roy W. Fouts as President-Elect of the Nebraska State Medical Society will be pleasurably received by his many friends. Dr. Fouts was one of the organizers of the Congress and served as President during 1931. He has always been a staunch supporter of Congress activities. No doubt his earnest efforts in behalf of his State Society earned for him the high honor of President-Elect. We are confident that the Nebraska Society has made no mistake. In fact, from what we know of Dr. Fout's capabilities, we are certain that he will direct the activities of the State Society in a manner to bring credit to all concerned. The Congress extends its congratulations.

New York Physical Therapy Society Meets

The scientific program of the New York Physical Therapy Society was presented April 1, 1936, at the Phi Gamma Delta Club, New York, and the following program was presented:

1. The Formation of Vasoactive Substances in the Skin by Physical Agencies. *Karl Harpuder,* M.D. (by invitation).
2. The Spa Treatment of Chronic Cardiac Cases. *Franz M. Groedel,* M.D. (by invitation).
3. The Saratoga Spa — What Physicians Should Know of Its Treatments. *Walter S. McClellan,* M.D., Medical Director (by invitation).

Kovacs Presents Paper Before Atlantic County Medical Society

Dr. Richard Kovacs read a paper on "Modern Methods of Thermal Therapy" at the Atlantic County Medical Society, Friday, March 13, at the Hotel Ambassador in Atlantic City. The paper was discussed by William H. Schmidt of Philadelphia and J. de P. Currence of New York.

New Ether Machine

The patented invention of Garnet King, M.D., Los Angeles, known as the *King Thermometer,* used by a number of surgeons in the Los Angeles County and other hospitals during the last three years, is now available through all surgical instrument houses.

The Thermanester is a small 1½ pound device made of moulded bakelite and copper. It consists of an ether tank, hot water chamber, a series of baffle plates, ether drip valve, air mixture valve, and inhalation and exhalation valves, the whole so designed to administer simply and nearly automatically highly heated, completelv volatilized ether vapor; it is used in both minor and major surgery and produces anesthesia without the usual after effects of nausea, vomiting, abdominal distention, or smarting of eyes or mucous membranes. This instrument promises to become as commonplace as the Baumanometer and stethoscope.

Meeting Pacific Physical Therapy Association

The regular March meeting of the Pacific Physical Therapy Association was held March 25, 1936, at the Hollywood Hospital, where the following program was presented:

1. Demonstration of Exercises Useful in Weight Reduction. *Cora Smith King,* M.D., Director of the Department of Physical Therapy, Hollywood Hospital.

Symposium on Diet —

2. Diet in Constipation. *Miss Adelle Davis,* Nutritionist, Author of "Optimum Health," Hollywood, Calif.
3. Vitamines and Their Practical Application. *John Q. A. Scroggy,* M.D., Los Angeles, Calif.
4. Diet as a Factor in Prevention of Disease. *Harold M. Walton,* M.D., F.A.C.P., Medical Director, Loma Linda Sanitarium and Hospital, Loma Linda, Calif.

Discussion opened by F. W. Fardner, M.D., Associate Professor of Chemistry, College of Medical Evangelists, Loma Linda, Calif.

Doctors Okay Peppermint Candy After Heavy Meal

The popular custom of offering guests peppermint candy or peppermint cordials after a heavy meal has scientific support in the findings of four Chicago physicians, Drs. H. I. Sapoznik, R. A. Arens, Jacob Meyer, and Heinrich Necheles (*Journal of the American Medical Association,* May 18).

Tests made both on dogs and on human beings showed that the oil of peppermint that is present in peppermint candy has a decided motor action on the stomach. Digestion is speeded up, and the stomach empties an hour faster. The peppermint is particularly useful after a meal with a high fat content, making the person's stomach feel less full and distended. — *Science News Letter.*

Obituary

We announce with deep regret the demise on March 1, of Dr. Frank Sherwood Meade, of Madison, Wisconsin, a long time member of the Congress. Dr. Meade was graduated from the University of Illinois College of Medicine in 1908. He has been a zealous and earnest follower of physical therapy. Since becoming a member of the Congress he has displayed an active interest in its affairs. Heartfelt condolence is extended to his family.

THE STUDENT'S LIBRARY

KURZWELLENTHERAPIE. By Dr. *Josef Kowarschik*, Primararzt und Vorstand des Institutes für Physikalische Therapie im Krankenhaus der Stadt Wien. Paper cover. Pp. 140 with 147 illustrations. Price RM. 9.60; bound RM. 10.80. Vienna: Julius Springer, 1936.

Every new healing method is ushered in on the wings of enthusiasm but requires impersonal, intelligent and conservative evaluation for its eventual place in our therapy. This generalization is particularly applicable to the present situation related to short wave therapy, for seldom has a method been so sharply split by opposing factions. The zealous have become zealots and the conservatists perilously reactionary. The work under review is therefore a welcome addition to the literature on short wave therapy, because it represents intelligent, concise and conservative evaluation of every important feature related to the subject. It is informative where others are enthusiastic; it is clinically analytical where others are speculative, and it is objective in deduction of the data without intent to color any of the existing facts in either direction. In other words, it is the hoped for work by one eminently fitted by experience and scholastic authority to present a balanced and critical evaluation of a method of great promise but not of overpromise. It is a book inscribed to the physician, to guide and advise him in moments when confronted with technical and clinical difficulties. Kowarschik is frankly suspicious of some of the mystical interpretations current about short waves, but is in agreement with those who interpret the condenser field action as due to a selective-thermic and not a specific-electric phenomenon. The volume is studded with practical suggestions and conservative interpretations. In the space of 140 pages divided into four sections including a fairly complete bibliography and an index, the author has managed to present all of the salient facts and discuss the moot problems in this promising new field of therapy. Perhaps the only criticism that may be offered is that the author underwrote the clinical section to the gain of detailed elucidation of theory and technic. From a practical point of view one would have welcomed more clinical discussions, not only as a literary balance against the more generous space provided for theory, but for its added value to those who accept the opinions of the author as one of the most conservative but best informed on the subject. This book is warmly recommended to students and practitioners conversant with the German language as a conservative and highly authoritative guide regarding the principles and practice of short wave therapy.

TÄGLICHE GYMNASTIK (Daily Gymnastics). By *Hanne Wassermann* and Professor Dr. *Oskar Frankl*. Paper. Pp. 18 with a chart of 36 photographic reproductions of exercise. Price MK. 1.50. Vienna: Wilhelm Maudrich, 1934.

As can be seen from the number of pages this is not a book but a small pamphlet, the principal feature of which is a removable large chart showing a young woman performing thirty-six exercises without any apparatus. The authoress is a well known teacher of gymnastics in Vienna. Professor Frankl is a distinguished gynecologist, who evidently wrote that part of the brief text which deals with the medical aspect of gymnastics. The technics of the exercises are fully described, as are the effects they have on the development of the body and the maintenance of health. Physical therapists interested in hygienic exercises will find this little brochure of help in advising their women patients how to go about to obtain the greatest possible benefit from daily exercises.

ALLERGY OF THE NOSE AND PARANASAL SINUSES. By *French K. Hansel*, M.D., M.S., Assistant Professor of Clinical Otolaryngology, Washington University School of Medicine. Cloth. Pp. 832, 58 illustrations — 3 color plates. Price $10.00. St. Louis: The C. V. Mosby Company, 1936.

The importance of allergy in relation to the nose and paranasal sinuses is now thoroughly recognized. In fact few if any rhinologists fail to consider the significance of possible allergic causes when studying a patient with any form of nasal or sinus disease. The subject of allergy in general has made rapid strides during the past two decades. In the special fields of rhinology and laryngology continuous research has brought forth interesting and valuable material which has definite, practical application. With the increased interest on the part of the rhinologist a systematic and well organized treatise dealing with allergy in this specialty is not only timely but essentially necessary. The present volume is comprehensive in scope. There is very little which could be added in the light of our present knowledge. The approach, furthermore, is rational and scientific without the over enthusiasm so characteristic of books on highly specialized subjects. The object of this monograph, expressed in the words of the author, is to familiarize the otolaryngologist with the clinical features of allergy as related to the field of otolaryngology, to review the various phases of the subject itself, and to point out the frequent association of the nasal with the other manifestations, particularly asthma, gastrointestinal allergy, allergic skin diseases, and allergic headache. The monograph also serves the purpose of familiarizing the allergist and the pediatrician

with the otolaryngologic phases. It is apparent from the text material that the author has that necessary combination of insights — in rhinology and in allergy. It is this combined knowledge and an experience of fifteen years which have qualified the author to present this work. Yet with the vastness of his personal familiarity with the subject, he has drawn from every source, compiling a wealth of information suitable for study and indispensable for reference. The biochemical, histological and bacteriological studies in connection with the clinical aspects of allergy have added worthwhile data. The same should be said of the discussion on the cytology of the secretions in allergy. Recent investigations in other phases of medicine have made possible a work up-to-the-minute. Hay fever, always an interesting problem to the general practitioner and specialist is broadly considered. Four chapters are devoted to this affection. Specific and non-specific procedures are evaluated and careful analysis made of ionization which lately has been brought prominently to the attention of the medical profession. There are 58 illustrations, several charts and color plates. The references after each chapter are complete and a considerable help to those who will seek more detailed information on special subjects. It is not too much to say that this monograph represents an outstanding contribution to rhinology and allergy. It should prove enlightening to those of the profession who are sufficiently progressive to keep pace with modern research in all the specialties of medicine.

KATHODENSTRAHL - OSZILLOGRAPHIE IN BIOLOGIE UND MEDIZIN (Cathode Ray Oscillography in Biology and Medicine). By Dr. Ing. *Wolfgang Holzer*, Assistant at the Physiologic Institute of the University of Vienna. Cloth. Pp. 155 with 74 illustrations, 16 plates and 22 mathematical tables. Price: 10 marks. Vienna: Wilhelm Maudrich, 1936.

Technical measurement by means of cathode rays is far from being new, for it was first introduced to physicists, physiologists, and others interested in the precision-measurements of physical and especially electrophysical apparatus by Braun in 1897. It was however not until 1914 that Dufour produced a device that proved applicable for measurements in the technic of high tension currents. Since then tubes have been invented which rendered cathode ray oscillography a precise method for measurements. The average medical practitioner lacks the grounding needed for a scientific investigation of electric apparatus, and this book will therefore prove of inestimable value rather to workers engaged in experimental laboratory research, electrical engineers, physicists and physiologists. Physicians engaged in electrocardiography will find information in this small book which is not contained in the monographs on electrocardiography, and through it obtain a thorough insight in the physics of their apparatus and in the fundamentals of their physiologic effects. A chapter on the production of electroneurographs of nerve tension (excitation) will prove of especial interest to neurologists, while another on the measurements of tonal waves will bring valuable information to otologists as well as physiologists. This is a highly scientific work which concludes with a critical survey of measurements with the cathode rays in biology and medicine. The small price for a book which involves so much energy and expense should induce every one interested in the subject to secure it even if one should have to obtain help in the perusal of the German text. The illustrations, graphs, and tables, whose legends present no especial linguistic difficulty, alone are sufficiently informative to open a new vista in the study of many physical agents used in therapy.

AN INDEX OF DIFFERENTIAL DIAGNOSIS OF MAIN SYMPTOMS. By Various Writers. Edited by *Herbert French*, C. V. O., C. B. E., M. A., M. D. Oxon., F. R. C. P. Lond. Consulting Physician to Guy's Hospital; late Physician to H. M. Household. Fifth Edition. Cloth. Pp. 1045 with 742 illustrations of which 196 are colored. Price $16.00. Baltimore: William Wood and Company, 1936.

This is the fifth edition of this treatise on the application of all the main signs and symptoms of disease to diagnosis. "It aims at being of practical utility to medical men whenever difficulty arises in deciding the precise cause of any particular symptoms of which a patient may complain." The articles on the various symptoms are arranged in alphabetical order, and the methods of distinguishing between the various diseases in which each individual symptom may be observed are adequately discussed. The value of a work of this kind lies in its easy availability for reference. The student and practitioner alike frequently require information for differential diagnosis. They will at once appreciate the arrangement of the material which affords a prompt means of obtaining the desired information. While this is the fifth edition the original purpose of the work remains unchanged; it is intended to be of help in arriving at a correct diagnosis in cases in which one or more symptoms are pronounced and yet the real nature of the malady is not immediately clear. There are 742 illustrations, of which 196 are colored. The collaborative effort is indeed a commendable work on the part of the publishers. The book is recommended without reservations.

INTERNATIONAL ABSTRACTS

Changes in Cerebral Cortex Produced by Thermocoagulation. J. G. Dusser de Barenne and H. M. Zimmerman.

Neurol. and Psychiat. **33**:123 (Jan.) 1935.

Dusser de Barenne and Zimmerman discuss the changes in the cerebral cortex produced in monkeys by thermocoagulation through local application of heat at from 50 to 80 degrees C. for short periods of time. The most suitable temperatures for laminar thermocoagulation of the cortex are from 65 to 80 degrees C. The depth of the lesion depends on the temperature applied and the duration of the application. Following thermocoagulation at a temperature between 65 and 80 degrees C., all the nerve cells have disappeared in the heated area after thirty-six hours. After from seven to twelve days the heated area appears as a devastated region, sharply delimited from the normal surrounding cortex by a wall of proliferated glia and fibroblasts. Inside the heated area the glia cells are still present and staining after twelve days. Application of lower, though still supernormal, temperatures to the cortex results in typical changes. Even the application of 50 degrees C. for half a minute to the cortex results in the death of all the nerve cells in the heated area; they have disappeared after thirty-six hours. It is of interest that in the chronic preparations (survival period of four months) the whole devastated area has disappeared. This fact proved that the glia present and staining in the "acute" preparations is no longer alive but also has been killed by the thermocoagulation. Scar formation and retraction of the adjacent cortex are absent in "chronic" preparations. This observation suggests the usefulness of this method in neurosurgical procedures on man. — [J. A. M. A. **104**: 799 (March 2) 1935.]

Quartz Light Therapy in Urogenital Tuberculosis. Stanley L. Wang.

J. A. M. A. **104**:720 (March 2) 1935.

Quartz light has been included as part of the treatment of urogenital tuberculosis for the past eight years. The general plan is to remove wherever possible the active lesions by surgery, and then to follow this by a long course of after care. The after care, as is also the treatment of inoperable patients, is based on the traditional method of treating tuberculosis; namely, rest, fresh air and proper diet. To these are added other measures and procedures that have been found useful and that seem indicated in the various kinds of patients. Among the useful measures is quartz light therapy.

The air cooled lamps have been very useful in the treatment of wounds and sinuses. Sinuses following the surgery of urogenital tuberculosis are of considerable importance, for they occur in a more or less certain percentage of patients. The sinuses usually ensue within a few weeks after the operative treatment, when as a result of abscess formation the incision line breaks open partially or completely. When the entire incision or a large part is involved, a deep wound is formed, which discharges pus profusely. The postoperative recovery is delayed and there is a long period of inconvenience as the result of the frequent dressing of the wound. Previous to the advent of quartz light therapy postoperative sinuses, particularly following nephrectomy for tuberculosis, had a long standing reputation for persistence, and there were numerous reports that drainage often continued for three years and occasionally longer. Besides the patients with sinuses following surgery there were other patients with sinuses from tuberculosis of the epididymides or testicles who were deemed inoperable or who refused operation. On the whole the results seem to indicate that the quartz lamps are of value in the treatment of wounds and sinuses in this class of case.

Irradiation of the interior of the bladder of patients with bladder tuberculosis has been carried on for more than a year and a half. The lamp used by the author differs mechanically and in its emission from the air cooled mercury vapor quartz lamps. Mechanically it is of the high voltage discharge mercury vapor type and operates at a temperature sufficiently low that the heat of the electrode is barely felt on the skin or mucosa. Fifteen patients were treated and the results were encouraging. This group presented a somewhat severe test, as all the patients had old bladder lesions that had not responded to other measures. Several had badly crippled bladder function due to extensive disease of the cystic wall, which had diminished the capacity and rendered the organ sensitive to small quantities of urine. The improvement, when it occurred, was evidenced by a lessening of the sensitivity and a decrease in the urinary frequency. Usually the intensity of the local symptoms was increased for from twelve to twenty-four hours following the treatment. One patient with a rather large ulcer showed a marked decrease in the size of the ulcer as seen through the cystoscope, and the urine became free from acidfast bacilli. Another became free from the bacilli, and the condition of the bladder interior seemed improved. One who was apparently much better also had a lessening of the number of bacilli in the urine. There was no improvement in symptoms or in the appearance of the bladder in four cases.

The treatments were tolerated remarkably well No harmful effects were seen. While not all were benefited, there was a sufficient number to warrant the belief that intrabladder therapy of this kind has a place as an adjunct or supplemental measure in the treatment of bladder tuberculosis. Perhaps patients with earlier and more favorable lesions would have improved results.

Gonorrheal Vaginitis in Children Treated by Diathermy. One to Three Years Follow-up. Robert J. Crossen.

J. Pediat. **6**:82 (Jan.) 1935.

Gonococcal vaginitis in children is not a self-limited disease which tends to fade out in a few months, as has been claimed. Statistics quoted from the article in which this statement is made show that over 37 per cent of the patients in that series had the disease for over a year and that one was supposed to have had it for seven years.

Theoretically diathermy has an advantage over locally applied antiseptics in that it raises resistance in the tissues themselves enabling the body to destroy gonococci deep in the tissues.

Practically, in actual results, the diathermy patients had consistently negative smears after twenty-nine weeks in the acute series, and these remained negative during a follow-up period which extended in some of the cases to twenty-five months.

The average length of treatment required to give consistently negative smears in the chronic cases was a little over four weeks. The longest follow-up in this group was three and one-half years.

Electrosurgery — A Discussion of Indications, Advantages, Disadvantages and Warnings Concerning Its Use. Harry E. Mock.

J. A. M. A. **104**:2341 (June 29) 1935.

Electrosurgery, or the application of certain electrical currents to the body tissues for surgical reasons, is no longer experimental but is rapidly becoming the procedure of choice in a limited number of surgical conditions. There are three end results which can be obtained by the application of certain electrical currents to body tissues: Dehydration, coagulation and section, or a cutting effect. A different type of electrical current is necessary to obtain these various results. In dehydration, as the name implies, there is an actual drying out or shrinking of the tissues, while coagulation produces more destruction, a homogenous granular debris, as when applied to sensitive tumor cells. In cutting, there is a rapid destruction of a thin line of tissue, with a separation resulting, quite similar to that obtained by incision with the scalpel.

It is not necessary for the surgeon to master the physics of the machine producing these currents, but it is imperative that every surgeon attempting to use electrosurgery should become thoroughly familiar with the effects on the tissues of these various currents. This can be obtained at first by experimentation on dead tissues and on the tissues of experimental animals. Naturally, continued use of electrosurgery in operative work adds to the surgical proficiency in the method. The mere possession of an electrosurgical machine by a physician in his office, or by a hospital, for his use, does not mean that that physician or the staff members of the hospital are competent to perform surgical operations. Surgical experience and judgment are still of paramount importance. Knowledge in the use of electrosurgery alone does not mean that one can enter one or all of the special fields of surgery through this gateway. One must have mastered thoroughly the special fields of surgery before one is competent to perform operations by means of electrosurgery.

Mock points out the danger and drawbacks of certain anesthetics, discusses the nature of wound healing, the indications, disadvantages and technic of electrosurgery in brain, breast, thyroid, malignant and other lesions of body. In competent hands and in indicated conditions, electrosurgery is an important adjuvant to classic surgery.

The Effect of Infrared Radiation on the Growth of Vitamin Deficient Rats. A. Szczygiel.

Am. J. Hygiene **21**:1 (Jan.) 1935.

The biological effects of infrared radiation have not been studied to any great extent, but there is some evidnece of a growth-promoting effect. Luce Clausen found that a ten-minute daily exposure to near infrared radiation (720-1120 mμ), of total energy value 0.122 gm. cal. per sq. cm. per min., from a carbon arc lamp, stimulated growth in rachitic rats and prolonged their period of survival on the rickets-producing diet, although there was no protection against the disease. In this investigation these experiments were repeated and similar exposures were given to rats on a vitamin A deficient diet. Infrared radiation of known energy content was given to young rats on vitamin A and vitamin D deficient diets. Radiation did not stimulate growth in the rachitic rats on the diet used but in three out of four experiments, the radiated vitamin A deficient rats grew better and showed a slightly longer survival period than the controls. However, the difference between the radiated and control groups was not striking enough to justify the conclusion that near infrared radiation has any specific stimulating effect on growth.

The Problem of Electric Shock. Horatio B. Williams.

Am. J. Surg. **27**:151 (Jan.) 1935.

The electrical resistance of the dry human skin is very high and it is to this circumstance that we are indebted for the relatively high immunity from 110 volt circuits. Death may result under certain circumstances from contact with 110 volt circuits. They come under the classification of asphyxial effects and are not necessarily attended with any heating effects or superficial burns, though these also may be present. These deaths are the result of the stimulating effect of the current. The usual commercial alternating current varies at the rate of 120 changes from zero to positive and negative maxima a second. Such an electrical current is admirably adapted to stimulate. If a feeble alternating current is applied directly to the ventricles of a mammalian heart, its regular coordinate beating stops and is replaced by a peculiar incoordinate action in which small groups of muscle fibers contract together, but no contraction of the whole heart occurs. Under this condition no blood is forced from

the heart and asphyxiation from lack of circulation soon takes place. When fibrillation of the ventricles occurs in a mammal with a heart as large as that of a man or a sheep it usually persists so long that death results. Occasional instances have been known in which recovery has taken place and such a case should never be given up without prolonged effort through artificial respiration to resuscitate.

It is possible merely by wetting the skin thoroughly with salt water to reduce the resistance to a few hundred ohms from one hand to the other. Under these circumstances contact with 110 volt circuits may easily prove fatal through causation of ventricular fibrillation.

Low voltage circuits do not constitute a serious hazard under ordinary circumstances. Neither do automobiles, yet we all know that many more people are killed by motors than by low voltage electric circuits. The important point is to recognize that in certain circumstances there is a hazard, to know how it arises and to take proper precautions.

Cheap and badly designed electrical appliances should not be permitted to be sold. Electric toasters and electric heaters sold for less than a dollar, as I am reliably informed they are, are apt to become death traps in use if they are not so when sold. The price is too low to have behind it good engineering or sound manufacturing.

The Local Treatment of Vasomotor Rhinitis. Taylor S. Burgess.

J. M. A. Georgia **24**:263 (July) 1935.

Vasomotor rhinitis is a puzzling disease. In the majority of instances it is difficult to determine the exact cause; and as in all diseases with obscure etiology many different methods of treatment have been advanced. It is conceded to be the end result of disturbance of the vasomotor nerve supply. Treatment has been advocated along three lines: (1) Treatment of the underlying cause of disturbance—allergic and drug therapy; (2) Treatment of the nerve supply—sphenopalatine ganglion therapy; (3) Mechanical management of the engorged tissue.

In my own experience any treatment short of operative work is a complete waste of time. As far as I know, no drug, either applied by the physician or by the patient, offers other than negligible relief. The only effective local treatment is some mechanical reduction of the obstructing nasal tissue, usually the inferior turbinate, occasionally polyps. This can be accomplished in three ways: (1) Surgical diathermy using the coagulating current; (2) electric cautery; (3) surgery. These are arranged in the order of their radicalness; and in the order of preference; since the aim of all local treatment is to secure a lasting reduction of tissue with the destruction of the least possible amount of epithelium.

Where it is applicable, and it is applicable in the majority of instances, I feel that diathermy is the treatment of choice. In the first place there is no destruction of epithelium. The scar is entirely submucous; and in contracting pulls the mucous membrane in with it, where cautery always destroys considerably mucous membrane. Then, too, there is definitely less reaction and discomfort following a diathermy treatment than following cauterization or surgery. This is a distinct advantage. If desired both sides can be treated at the same sitting. Diathermy is used in two ways: (1) Bipolar where two parallel needles are introduced into the tissue. I prefer this method. The other method consists of using a large inactive electrode applied to some distant region of the body and a single active needle electrode thrust into the turbinate. Each machine has its own setting but 300-500 milliamperes at the site of application is required. The correct setting can be determined in advance by using the instrument on a piece of meat. In actual work a slightly higher setting than this will be required. With the machine correctly set the needles are introduced to a depth of ½ inch; and with a foot switch the current is turned on and allowed to flow from three to five seconds, or until a white area appears at the site of introduction of needles. A local anesthetic is used; preferably one which is not a vaso-constrictor. Two per cent nupercaine or metycaine is satisfactory. The reaction is usually negligible; and some relief is obtained immediately, the maximum amount of benefit being obtained in about six weeks.

Diathermy in the Treatment of Diseased Tonsils. J. A. Lumsden Cook.

The Practitioner **133**:194 (Aug.) 1934.

The relative merits of diathermy in the treatment of diseased tonsils, as opposed to surgical enucleation, have come under considerable discussion during recent years. The consensus of opinion has been in favor of operation, as extirpation by diathermy has not been considered possible. This is probably owing to the fact that many patients have had to submit to operative treatment for removal of tonsillar tissue after they had undergone diathermy. It must, however, also be remembered that many remnants following enucleation are also treated by diathermy. Most patients do not like to undergo another operation on the throat, an in these cases diathermy is an excellent means of getting rid of the remaining nodules of tissue. Surgical enucleation is, without doubt, the method of choice, but there are many cases in which this is impracticable, and in these cases it is possible to treat by diathermy and eradicate the tonsillar tissue, provided the surgeon as acquired a good technic and has chosen the type of case with care. The cases suitable for surgical diathermy are:

1. Elderly patients, to whom the shock of operation might prove serious and in whom the tonsil is generally of the small fibrotic type.

2. Where general anesthesia is contraindicated or would add considerably to the risks of operation. Especially does this apply to cardiac and nephritic cases.

3. Patients who have a phobia regarding anesthetics.

4. Where the patient cannot afford the time to lie up after operation, and in these cases the treatment can be spread over an indefinite period.

5. "Bleeders." In these cases it is advisable to

do small areas at each sitting and avoid charring of the tissues.

6. Singers. The risks of interfering with the timbre of the singing voice are not inconsiderable when operation is resorted to, owing to the risks of damaging the pharyngeal muscles either directly or later by fibrosis.

7. Fragments remaining after an indifferent operation.

8. Calculi, when sufficiently near the surface, are readily removed by coagulating the tissue surrounding them.

A marked improvement in general health is observed before many treatments have been carried out. This is particularly noticeable in anemias and arthritis due to tonsillar sepsis, and suggests that even partial ablation by diathermy is of value in the treatment of diseased tonsils. This improvement in health is due to the sterilizing effect of the heat generated in the tissues, and compared with the improvement observed in prostatitis. In tonsillar diathermy, however, the temperature of the tissues is raised to a greater degree with the more rapid destruction of the infecting organism.

Derangements of the Knee Joint. Melvin S. Henderson.

Southern Surg. **3**:123 (June) 1934.

When called upon to treat a patient for primary locking, the knee should be manipulated and straightened. This can often be done without anesthesia. The patient should be recumbent, preferably on a low, flat, firm table. If the left knee is involved, the surgeon, standing at the left of the patient, should flex the knee to a right angle while the thumb of the surgeon's left hand is firmly held over the anterior end of the internal semilunar cartilage. The ankle should be held firmly in his right hand. With the cooperation of the patient, and at the count of three, the knee should be forcibly extended and, at the same time, the tibia rotated inward, the surgeon pressing firmly with his thumb on the anterior end of the cartilage. This movement tends to unlock the joint. If the knee goes into complete extension and the patient says the knee "feels right" all is well, but if this reassurance on the part of the patient is lacking, the probabilities are that reduction has not been accomplished and that the maneuver should be repeated. If neither surgeon nor patient is satisfied, the chances are that a bucket-handle fracture is present with the loope held firmly in the intercondylar notch. If reduction is satisfactory, a posterior splint should be applied and worn for two weeks until all soreness and swelling have subsided. Diathermy or radiant heat may hasten absorption of the effusion. If the cartilage was merely pinched and not fractured, subsequent locking may not occur, but if there was a fracture, attacks of locking will almost certainly follow, and removal of the offending meniscus will be necessary. If reduction was not accomplished satisfactorily the patient should be put to bed with the leg held as nearly straight as possible in a comfortable position. Heat affords relaxation and, as the swelling subsides, the knee may straighten of its own accord, without the act of reduction being definitely noted. If it stays locked, exploration is advisable.

Treatment of Diffuse Peritonitis. B. Breitner.

Beitr. z. klin. Chir. **159**:340 (April 14) 1934.

Breitner reports ten cases of diffuse suppurative peritonitis treated with the method of irradiating the intestine with ultraviolet rays during the course of the operation. The method was originated by Havlicek, whose purpose in irradiating the intestine during the operation was to study the circulation. Havlicek noticed that the convalescence of patients who had been irradiated was painless and brief. In the last three years he has operated on 108 cases of diffuse suppurative peritonitis without a death. The latest large statistics of Kirschner on diffuse peritonitis showed a general mortality rate of 47.7 per cent and for those of appendicular origin a mortality rate of 38.5 per cent. Havlicek removes the focus of infection, after which a coil of intestine is brought out if possible with its mesentery and the omentum. This is irradiated on either side with ultraviolet rays from a distance of about 35 cm., the procedure lasting from five to twenty-five minutes. Of the author's ten patients, eight recovered and two died. The theory explaining the effect of the treatment is as follows: The patient with peritonitis dies, as a rule, because of cardiac failure. This failure is due to withdrawal of a large amount of blood that is stagnating in the splanchnic capillaries: the patient is said to bleed into his own splanchnic area. Irradiation of the intestine releases the histamine, the effect of which is to open the direct arteriovenous anastomoses and to raise the pressure within the portal vein. Circulation is thereby quickened, the minute volume is increased and the danger of cardiac failure is obviated.—J. A. M. A. **102**:2071 (June 16) 1934.

The Immunological Import of Electrosurgery in Rhinolaryngology. Lewis J. Silvers.

Med. Rec. **141**:33 (Jan. 2) 1935.

It has been noted that a reaction, specific in nature, occurs with each electrosurgical treatment of an infected focus. More recent observations bring to light a rational explanation for the "immunity reaction" which follows electrocoagulation. In order to appraise this so-called autogenous vaccine reaction an analysis of one hundred electrosurgical tonsillectomies was undertaken. The author observed that after the beginning of electrosurgical extirpation of the tonsils in patients suffering from neuritis, myalgia or arthritis, relief from pain was quickly afforded. This relief of distal pain following the first few applications of surgical diathermy to the infected tissue was responsible for the present investigation. The immunological changes that occur after electrosurgical treatment of the tonsil, suggests that a definite variation in the type of the "reaction" exists. The reaction may be general as well as local in character. The general reaction simulates the response to the autogenous vaccine inoculation of a virulent organism. It is apparently specific in nature. The occurrence of the relief of distal bodily pain and stiffness is independent of the total sterilization of the tonsil.

PRESENT STATUS AND TECHNIC OF ARTIFICIAL FEVER *

UPTON GILES, M.D.

NEW ORLEANS

For the past fifty years physicians[45-50] have suspected that fever might be part of the defensive mechanism of the body against invading microorganisms. It was Wagner-Jauregg,[49] who first successfully produced fever in hopeless paretics by malarial injections, which demonstrated the soundness of the concept. Previous to this time, in the treatment of syphilis, gout, arthritis and other chronic conditions, increased bodily heat was induced mostly by physical measures. These were applications of hot blankets, hot air, hot water, steam and mud from natural or artificial sources. While these measures were used empirically, distinct beneficial results were obtained.

In 1884, Phillips,[52] while visiting Hot Springs, Arkansas, experimented on himself and demonstrated the value of temperature-rising baths. Since Jauregg's epochal experiments, many other methods of producing therapeutic fever have been evolved and used with varying degrees of efficiency and safety.

Of the medical or non-physical methods, the injections of crystalloid and colloid substances[41] and of heteroproteins, such as peptones, milk[54] and casein, may be mentioned. Others have injected vaccines prepared from typhoid, paratyphoid and other microorganisms.[20] Inoculations or organisms from erysipelas, undulant fever,[35] rat bite fever[38] and tertian malaria[12-49] have been employed. These methods, usually classified as physiologic, really should be grouped as pathologic, for they depend upon the reaction of the body to the introduction of a foreign substance. The reaction in different individuals varies, and can neither be predicted nor entirely controlled in all instances.

Effect of Malaria Treatment

Following v. Jauregg's and Kyrle's[23] astounding results in paresis with malarial plasmodia, this form of therapy became widely used both in Europe and America. Although malaria has been our most satisfactory method of treatment in paresis, it has many dangers. In 100 cases reported by Bahr[3] and Breutsch,[4] 23 died during or following the malarial paroxysms. In a recent review of the literature Karnosh and Williams,[26] collated 580 cases of paretics who had received inoculations of malaria. These showed a wide array of symptoms and complications with a death rate of 12.7 per cent. Hemorrhages, hematomas, and non-inflammatory ulcers were considered specific lesions due to malarial infections. Enlargement of the spleen and rupture of this organ in some cases produced shock and immediate death. In addition, after injection of the malarial organism, many rapidly fulminating septic states developed, thus suggesting a symbiotic relationship between the plasmodium and many pathogenic organisms. Evidence of serious complications were noted and include jaundice; cyanosis of varying degrees; paroxysm with a temperature of 105.8 degrees F. lasting eight hours following the chill; blood urea of 60 mg. per 100 cc.; and low temperature accompanying an unusually high pulse and respiratory rate. Regarding re-

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* Read at the meeting of the Southern Section, American Congress of Physical Therapy, New Orleans, March 23, 1936.

sistance, physical habitus was no index, for the robust appearing individual developed severe collapse as often as the asthenic patient. Bronchopneumonia was found in thirty-five per cent of the fatal cases. It is of significance to state that in some instances, we are giving a disease that is difficult to cure; some individuals, particularly the colored race, exhibit an immunity to malaria. We know of no way of controlling the intensity and severity of the malarial attacks without stopping them completely.

There is a vast difference of opinion regarding the action of the various forms of hyperpyrexia. Schamberg and Rule[39] showed that repeated hot water baths not only prevented the appearance of characteristic lesions of experimental syphilis in rabbits inoculated with spirochaeta pallida, but caused testicular syphilomas and secondary syphilitic ulcers to disappear. Some think there is a specific biologic interreaction of some sort between spirochaeta pallida and plasmodium vivax. Breutsch and Bahr[4-3] believe that clinical remissions in paresis result from a response of the reticuloendothelial system to the malarial organism. In this, the height of the temperature bears little or no relation to the question of recovery. Neither of these theories has been confirmed. Some are of the opinion that the benefit derived is due to the fever itself and not to the chemical changes in the body resulting from the introduction of any particular foreign organism. Others believe the therapeutic effect in syphilis is not due to fever alone, but possibly to a combination of the fever and its accompanying biologic reaction. To support this view, O'Leary[34-43] states that he has observed patients who had undergone "malarial therapy for active neurosyphilis which appeared during the stage of acute syphilis, developed cutaneous and mucous membrane recurrences six months or more after the fever treatment; likewise, the appearance of cutaneous gumma in paretic patients following fever therapy is evidence that the spirochetes were not destroyed by the heat." To further confirm this view, it is significant that the good results from fever therapy required a year or more to develop.

Long after the discovery by d'Arsonval that high frequency current raises the bodily temperature, came another confirmation by Binger and Christie[2] that heat could be produced in living tissues. D'Arsonval's discovery stimulated Neymann[31] to treat his patients by means of artificial fever by induced high frequency current. He thought fever induced in this manner should settle the problem of the spirocheta pallida and plasmodium vivax with reference to specificity or the biologic interreaction theory. The published results of Neymann and Osborne,[31-32] and King and Cocke,[22] pioneers in this form of therapy, demonstrated that therapeutic results obtained by diathermy equaled those of malarial therapy without the fatalities usually occurring by the latter method. Fatalities following the injection of malaria in some series of cases were as high as 23 per cent, with a general average of 12.7 per cent, as compared to one per cent or less in induced fever therapy by physical measures.

Through the demonstration of the value of this type of therapy by physical measures, many mechanical means were produced to induce therapeutic fever. They are listed as follows, but not necessarily in order of their evolution.

1. Hot Water Baths (used for many years empirically).
2. Diathermy.
   (1) Conventional or damped type of high frequency current.
   (2) Short wave or undamped type of high frequency current.
      a. Electrostatic field.
      b. Electromagnetic field.

3. Electric Blankets.
4. Cabinets.
   A. Heated Air Cabinets.
      (1) Humidified air blown over patient.
         a. Air heated by resistance units.
         b. Air heated by resistance units and incandescent bulbs.
      (2) Still air cabinets.
         a. Heated by incandescent bulbs.
   B. Condenser field cabinets.
      (1) Patient heated only by electrostatic field.
      (2) Patient heated by electrostatic field in conjunction with heated air.
         a. Hot air heated by incandescent bulb.
         b. Hot air heated by resistance unit.
   C. Inductotherm cabinets.
      (1) Patient heated entirely by electromagnetic induction. (Air is humidified in cabinet only for comfort and insulation.)

The therapeutic value of artificially produced fever is fairly well established. Artificial fever is known by various writers as hyperpyrexia, hyperthermia, pyrexitherapy, pyretotherapy, thermogenesis, electropyrexia, radiothermy, inductothermy, inductopyrexia and aseptic controlled fever.

It is not the purpose of this paper to attempt to determine the best method to use, for the one which is advantageous to the patient, producing the required fever with the greatest amount of comfort and safety should be employed. We also wish to outline the technic of fever therapy and to state why electromagnetic induction is a valuable method of treatment in many cases.

Electromagnetic Field

Raising the body temperature by means of induced heat is both unique and logical. Heat is produced by electromagnetic induction from within the patient's body by means of an alternating electromagnetic field. The patient is placed within this field; eddy currents are set up in the vascular tissue, thus causing a gentle rise in temperature. Without any contact of electrodes the alternating field is induced in the patient's body by means of a coil. Thus the heat is produced within the patient's body and is not conducted into it by a higher environmental temperature.

Many of the undesirable physiologic effects are avoided. Because of the fact that no excessively high temperature surrounds the patient, no danger of burns from this source exists. As the electromagnetic field is not distorted by moisture spots appearing on the patient, no danger of burns exists from the concentration of heat within any small area. This method does not disturb the basic physiologic relationship, and therefore seems to approach the ideal in both comfort and safety. The reverse, however, is true whenever external heat is applied to any extent.

This method can be used in any one of several ways for producing artificial fever. The patient may be placed in a fever bag made of suitable heat-insulating material. This bag is equipped with a "zipper" arrangement which closes the bag tightly, encircling the patient, only his head protruding. The alternating field is created in either of two ways when using the bag. The coil can be placed around the outside of the bag (fig. 1) encircling

Fig. 1 — Illustrating the technic of Electropyrexia. Three turns of the closely wound cable is placed around the outside of the treatment bag encircling the patient. The third turn of the long cable is omitted here for purpose of photography.

the patient, or it may be used in "pancake" form (fig. 2); in the latter case a disc twelve inches in diameter, which contains the coil, is placed near the patient. In both cases the electromagnetic field is thus induced in the patient's body without any contact whatsoever.

Fig. 2. — Illustrating the use of the Pancake Coil which permits freer movement of patient.

The Kimble cabinet (fig. 3) is another method for the production of artificial fever. This apparatus consists of an air-conditioned cabinet in which the patient lies with his head protruding through an opening. The patient is surrounded by an atmosphere of conditioned air which is just comfortably warm. This SLIGHTLY warm air is not for the purpose of heating the patient, but, by maintaining approximately the same temperature in the cabinet atmosphere as within the body, heat dissipation is prevented, insulating properties are greatly augmented, and the patient is made increasingly comfortable. Heat is applied to the patient by means of a "pancake" coil, (fig. 4) placed on an adjustable bracket inside the cabinet and directly over the pa-

Fig. 3. — Illustrating the Kimble Cabinet. Heat is induced from a coil of the Pancake type. The coil is energized by means of the Inductotherm.

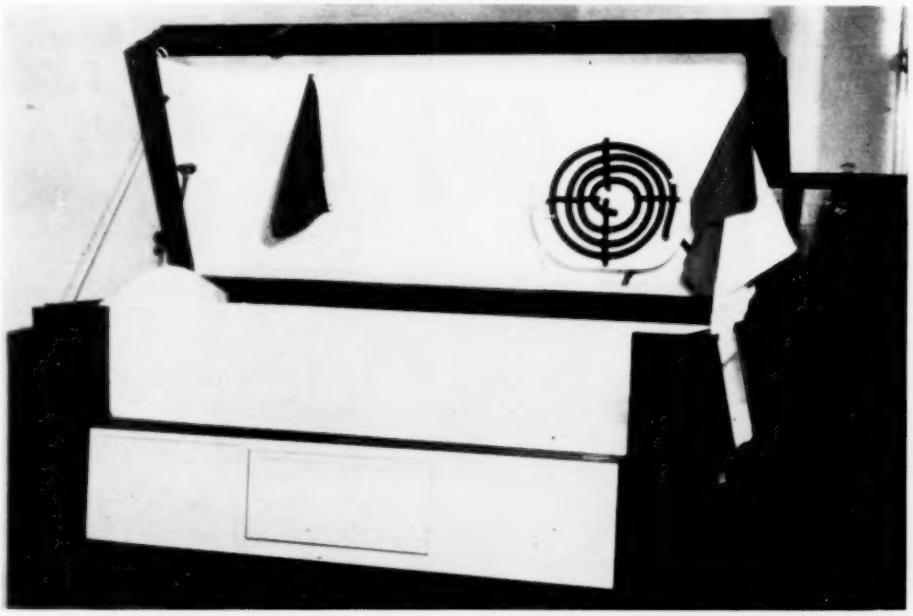

Fig. 4. — Illustrating the Pancake Coil of the Kimble Cabinet. The coil is raised or lowered by means of an adjustable bracket inside the cabinet and placed directly over the patient.

tient. The ends of the coil protrude through holes provided for them and are plugged into and energized by the apparatus. The slightly warm air is passed over a humidifier, which adds further to the comfort of the patient. The temperature of the air inside the cabinet is automatically maintained at 100 degrees F. by a thermostat. Rectal temperatures are obtained through a special door. Thus all the good points of the cabinet method are incorporated and most of the undesirable effects avoided. The current consumption when using the Kimble cabinet in conjunction with the inductotherm is much smaller than with the hot-air cabinet. This is due to the excessive current consumption as used in the grid type resistance units which some-

times require special lines for carrying the current. The patients who have taken treatments both in the insulated bag and the Kimble cabinet invariably favor the latter. We have observed that the pulse of patients is slightly more rapid when taking treatment in the cabinet than when taken in the bag, but too few comparative tests have been made to state this as a fact. The patient's temperature has ranged between 105 and 106 degrees F. for five hours. Temperatures of 107 degrees F. have not as yet been induced.

Clinical Results

Syphilis. — From a sufficiently large number of experiments we may safely conclude from the result obtained, that high body temperature exerts an unfavorable influence upon the causative organism.

Weichbrodt and Jahnel[55] placed rabbits with scrotal chancres in an incubator producing a temperature range of 104 to 107.6 degrees F. These animals were subjected to this temperature 30 minutes once or twice daily for three to five weeks. After the second day the spirochetes gradually lost their motility, became less in number, and finally disappeared.

Carpenter, Boak and Warren,[13] by means of the diathermy current, prevented the development of chancres in twenty-one out of twenty-five rabbits in whom treatment was begun five and seven days after inoculation. Two rabbits developed lesions but became normal after further diathermy treatment. Two rabbits died. The eighteen rabbits used for control purposes developed the typical lesions of experimental syphilis. These workers also discovered that one febrile period of 106.7 to 107.6 degrees F. was sufficient to destroy the inoculated organism.

In 1924, Kyrle[23] published a report of two hundred thirty-two seropositive patients with early syphilis of under two years duration. They were given a course of malarial therapy consisting of ten chills, followed by a course of arsphenamine therapy. The blood serological reactions were favorably influenced in two hundred thirty of the patients after this single pyretochemotherapy course of treatment.

Richet and Dublineau[37] in a series of experiments with animals and human beings demonstrated that early syphilis may be more easily cured by combined fever and chemotherapy than with chemotherapy alone.

The combined clinical studies carried out by Stokes, Cole, Moore, O'Leary, Wile, Clark, Parron and Usilton[44] showed the presence of abnormal spinal fluids in 33 per cent of the patients with early syphilis, and 56.1 per cent of patients with secondary syphilis.

With the information noted above and with the hope that the disastrous late neural and visceral manifestations of syphilis may be prevented, Simpson initiated his régime of sustaining a fever temperature above 105 degrees F. with the Kettering apparatus for fifty hours and thirty injections of antisyphilitic chemotherapy. He subjected twenty-six patients, none of whom had previously received treatment, to this method of treatment. As a control measure six patients with primary or early secondary syphilis were treated with only fifty hours of fever therapy above 105 degrees F. A second control group of fourteen patients with primary and early syphilis received only thirty weekly chemotherapeutic injections. His experiments gave suggestive evidence that fever therapy alone or chemotherapy alone is often inadequate. It also demonstrated that combined fever and chemotherapy is a superior form of treatment in early syphilis, particularly in patients who do not respond to orthodox therapy.

Dementia Paralytica. — Working with the Kettering apparatus, Simpson[42] reports twenty cases of dementia paralytica, each completing a course of fifty hours of fever therapy in addition to thirty conventional injections. Of these, twelve showed complete clinical remission and two have been restored to a working status; thus fourteen patients, or 70 per cent, have been socially rehabilitated. Four patients were accorded 50 per cent clinical improvement while only two were regarded as receiving 25 per cent improvement. No relapses have occurred since treatment.

Tabes Dorsalis. — Simpson reported results in ten patients afflicted with tabes dorsalis who had received chemotherapy. Three of these had received malaria therapy, one of whom had temporary remission after the first inoculation. Ataxia was present in nine; lancinating pains and gastric crises were present in all. Two patients with ataxia were restored to a normal gait; six showed improvement; while two showed no change. Usually after the second or third treatment, lancinating pains in each case disappeared. Normal function was restored in one case of so-called cord bladder.

Tabetic Form of Dementia Paralytica. — Out of seven patients treated by Simpson, six showed improvement in mental orientation; root pains in each disappeared; one patient with cord bladder was restored; one patient restored to normal gait; four were improved in gait.

Diffuse Central Nervous System Syphilis. — In this group Simpson reported thirteen patients with varied manifestations of neurosyphilis which could not be definitely classified as dementia paralytica, tabes dorsalis or the tabetic form of dementia paralytica. Six were congenital and seven were acquired. In this group ocular symptoms predominated. Symptomatic remission occurred in nine of the thirteen patients; moderate improvement, in three; and in one, no improvement at all.

Asymptomatic Neurosyphilis. — In seven patients with asymptomatic neurosyphilis, spinal fluid reactions were reversed to negative in six and less positive in one. All patients had had no effective chemotherapy.

Resistant Seropositive Syphilis. — All of these patients are classed as so-called Wassermann-fast cases. Simpson states that intensive courses in chemotherapy had been administered to all. The serological reactions were reduced to negative in four, became less positive in two, and remained positive in one. Spinal fluid reactions remained negative in all.

Treatment of Neurosyphilis at the Charity Hospital

While Simpson in his classification of cases endeavored to establish a régime of pyretochemotherapy, our investigation has been more clinical. We feel that sufficient evidence has already been given by Neymann, Simpson and others to justify the acceptance of pyrexia as a treatment of syphilis of the central nervous system. Our efforts have been directed toward the relief of otherwise hopeless cases; namely, dementia paralytica, tabes dorsalis, taboparesis and resistant seropositive syphilis (Wassermann-fast cases) which, in our group was usually accompanied by cardiovascular, optic atrophy and other complications.

Twenty-two cases were selected for treatment with fever therapy. These were growing progressively worse under exclusive treatment with tryparsamide and other forms of heavy metal. Three had received inoculations of tertian malaria with no benefit. Several patients were not physically fit subjects for malaria therapy. Of this group six showed improvement, eleven marked improvement; and five, spectacular improvement.

We have used electromagnetic induction only as a last resort in those

cases of neurosyphilis who could tolerate no other forms of therapy enumerated above, or who were growing progressively worse under a conventional régime. We realize that this is not a fair evaluation of pyretotherapy, for we have selected seemingly hopeless cases. It has naturally been the heroic method as a last resort. The general comment elicited from this group was that within two or three days after each fever session, they felt much better, and after each successive treatment, most patients expressed a feeling of well-being.

For comparative purposes, 21 cases of neurosyphilis were inoculated with tertian malaria with the following results: Ten showed improvement; four marked improvement; and two evidenced spectacular improvement. Of the five malarial cases that showed no improvement, three were later treated by electromagnetic induction, with improvement of subjective and objective symptoms, as reported by Dr. Howles.

The literature shows marked variations in remission in neurosyphilis from fever produced by malaria and mechanical measures. Indiscriminate selection of patients accounts for the diversified results obtained even though identical methods of treatment have been employed. As for example Neymann[5] reported ten mild cases of dementia paralytica who had eight remissions of symptoms following fever therapy. Later Neymann and Koenig reported that fifty demented cases had only twelve remissions.

This means of selection of cases illustrates the almost contradictory reports appearing in the literature.

Gonococcic Infection. — Carpenter, Boak, Mucci and Warren[12] undertook to ascertain the thermal death rate of gonococci. This they did by consecutively subjecting fifteen strains of gonococcus to temperatures of 104, 105.4, 106.5 and 107.3 degrees F. All the strains subjected to these temperatures had been cultivated for a period varying from one month to twelve years. The oldest culture best tolerated heat. Notwithstanding this variation in tolerance, 99 per cent of the cultures could not withstand a temperature of 105.4 degrees F. for more than four or five hours. One per cent required 23 hours for destruction. At a temperature of 106.5 or 107.3 degrees F., 99 per cent were destroyed in two hours. One per cent required heat of 106.5 degrees F. for from seven to twenty hours. To the thorough investigation of Carpenter, Boak, Mucci and Warren we owe the possibility of rapidly curing gonococcic infection. No other microorganism has been subjected to a temperature tolerable by the human to cause its destruction.

The most spectacular success has undoubtedly been obtained in gonorrheal infections, including complications of prostatitis, salpingitis, periurethritis, and cervicitis. Desjardins and his co-workers[15] state that in 90 per cent of the gonorrheal cases three to six sessions of sustained fever of 106 and 106.7 degrees F. of five to eight hours duration are sufficient for a complete and permanent cure.

Arthritis. — In gonococcal arthritis the results of fever therapy have been astounding. The work of Short and Bauer,[16] Hench, Slocum and Popp[17] and Slaughter and Trautman shows that in gonococcal arthritis fever therapy has a sterilizing effect, while in the non-specific, infectious type, the causative germ may not be susceptible to heat. In a survey of rheumatoid patients,[18] treated by diathermy 20 per cent were improved, 28 per cent remained unimproved, and 52 per cent were rendered definitely worse. With gonococcal arthritis there is a striking contrast, 66 to 90 per cent having been reported as "cured," and none without some benefit from the treatment. It is therefore important to point out that patients with chronic, infectious arthritis have only one chance in five for recovery. With them, hyperthermy

should not be used to the exclusion of other methods. In gonococcal arthritis one hundred per cent recovery may be expected.

Other Diseases. — Favorable reports appear in the literature on the treatment of the following diseases by artificially induced fever: Intractable bronchial asthma, chorea, corneal ulcer, pulmonary tuberculosis (mild), epidemic encephalitis, bronchitis, cystitis, pyelitis, osteomyelitis, multiple sclerosis, chronic sinusitis and paralysis agitans. The treatment of diseases other than neurosyphilis, gonococcic infection and its complications is still in the experimental stage.

Contraindications. — Contraindications to the use of fever therapy will vary with the degree of temperature elevation.[8] A few degrees of fever certainly will not place as much of a burden on the cardiovascular and other systems as would a higher elevation in temperature.

Advanced age is usually considered a contraindication for fever therapy; however, ages from two to seventy-five are reported in the literature. Patients with advanced pulmonary tuberculosis, renal or cardiac disease should not be subjected to fever therapy. Any contraindication to major surgery is likely to be also a contraindicated to fever therapy.

Technic

The following régime is used in our production of fever. The patient is first subjected to a physical, neurological and laboratory examination. He is given an enema the night before treatment or at about five in the morning of the treatment. Breakfast is limited to fluids. Three grains of sodium amytal or some other sedative is given as the patient leaves the ward. On arriving at the physical therapy department at seven-thirty, the patient is weighed and placed on the fever bed. A terry-cloth or large bath towel (fig. 5) is wrapped around the patient. He is then placed in an insulated zipper bag (fig. 1) the head only remaining exposed. The mattress on the fever bed is in two parts (fig. 5). Between them is an opening into which the heating coil is introduced. This coil is wrapped three times about the body of the patient (fig. 1). The full force of the apparatus is employed until the temperature of the patient registers 104.5 degrees F. The current is cut off to permit the usual coasting upward of one-half degree of temperature. The temperature, pulse, and respiration are taken and recorded every fifteen minutes.

Many patients will retain a temperature of 105 degrees F. for several hours after an interruption of the current; others will require earlier reestablishment of connection with heat. The temperature of 105 degrees F. is usually reached in sixty or ninety minutes and maintained for five hours. Usually, at about noon, the patient becomes restless and requires another sedative. Fluids, such as 0.6 per cent saline and water, are given sparingly until a temperature of 105 degrees is reached. Then fluids may be administered more often, if desired, 1500 to 2500 cc. being the usual amount given.

The patient is moved from the fever bed; then he is placed on a dry bed and covered with one or two blankets. At this time the intake of fluids is forced. The temperature rapidly descends from 105 to 103 degrees F. from which point it proceeds more slowly to normal. It requires from forty-five minutes to an hour for the temperature to reach 100 degrees, when a bath is given. The patient is sent to the ward where an infusion of ten per cent glucose in normal saline is administered. In two hours the patient is usually up about the ward and is feeling fine. When treatment is given in the bag, the patients lose an average of six pounds; while treatment given in the

Fig. 5. — Illustrating the proper arrangement of terry cloth about patient's neck to prevent heat loss. Note the trough or separation of the upper mattress. This separation permits an air space between the coil and patient which eliminates skin burns.

cabinet causes a loss of from one to two pounds. Treatments are given biweekly.

Physiologic Manifestations

In the production and maintenance of fever in the body, it is inevitable that profound biochemical and biophysical changes occur.[8] With a rise in temperature there occurs an increase in pulse rate; its rapidity is found to be generally proportionate to the temperature elevation. The increase is approximately 6 to 10 beats per minute for each rise of one degree F. The velocity of the blood flow is accelerated.

The effects of a temperature rise invariably cause an early elevation of blood pressure which apparently is of short duration. This is followed by a gradual decrease of blood pressure to a point below the reading normal for the patient. Invariably there is an associated lowering of the diastolic pressure, usually from 10 to 35 mm. of mercury. When employing the usual auscultatory method of taking blood pressure, the mercury in the manometer infrequently descends to the zero mark. This phenomenon is believed to be due to a wide open aortic ring, but the result of an increased heart rate and dilatation of the peripheral vessels.

The blood picture shows most interesting changes. Slaughter and Trautman state that there is a fluctuation of the white cells from 10,000 to 50,000 throughout treatment. The percentage of neutrophilic polymorphonuclear leucocytes is increased and that of the lymphocytes correspondingly decreased. "The neutrophilic polymorphonuclear leucocytes constitute the most of the early response. Lymphocytes early in the treatment drop to a low count and may be as low as 200 to 500 cells. Only rarely do they show tendency to reappear during the treatment. This reappearance of lymphocytes is usually for a short time only. There is a reappearance of lymphocytes to normal a few hours after treatment." During the first phase of the treatment, just before the initial rise, there may be a temporary decrease in number of white blood cells. This temporary decrease is considered to be an expression of blood dilution. The increase of the white cells is probably

due to the stimulation of the hematopoietic system, as the Arnett and Shilling index shows a shift towards the left. Usually the leucocyte count returns to normal within twelve to twenty-four hours. The acceleration of the leucocytes is in proportion to the degree of temperature, similar to that of a chemical reaction. Elevation of temperature at first produces an increase of blood volume, but with subsequent sweating, a concentration occurs. The initial increase in blood volume is due to fluids absorbed from the intestinal tract, muscles and other parts of the body. The venous blood contains greater quantities of oxygen accompanied by an increase of hemoglobin. The red cells show very little change as a result of fever therapy. The slight increase in some cases is certainly not in proportion to the leukocytic increase.

Chemical examination of the blood reveals changes that are transient in character. Perkins',[53] observation is similar to that of Neymann and Osborne. The non-protein nitrogen shows an elevation of approximately 11 per cent during the first prolonged fever treatment. This increase is usually manifested throughout the series of fever treatment; however, it returns to normal within a few days. The urea nitrogen shows an increase, ranging from 13 to 19 per cent, but it also resumes its normal level soon after the elimination of the fever. The blood sugar changes show an increase of approximately 20 per cent. No appreciable increase is observed in the uric acid and creatinin contents of the blood. The blood shows a temporary decrease in chlorides, if there is a failure to administer saline during the treatment. The literature seems to contain conflicting data regarding the effect of increased temperature on the blood-immune bodies. The gastric secretion shows a reduction both in free and total acids as a result of temperature elevation.

The brunt of early rise of temperature is borne by the cutaneous surfaces. The temperature of the skin varies considerably in different parts of the body. Temperature variations affect the skin by producing changes in its vascular mechanism, such as sweating and evaporation of fluids. There is a loss of CO_2 during an excessive and prolonged temperature rise, accompanied by increased respiration and alkalosis. The hydrogen ion concentration shifts toward the alkaline side with increased plasma pH values.

Elevations of temperature of the body tissues produce an increased metabolism. According to the law, van't Hoff,[14] a rise of 10 degree centigrade increases the rate of oxidation two and one-half times.

The rationale of fever is not thoroughly understood. Induced fever by artificial measures is different from that produced by infectious processes. By means of the high frequency current, electrical energy is converted into heat within the body. The heat generated is the result of resistance offered to the current by the body tissues. Fever is produced by convective and conductive measures, such as rádiant energy, when it is applied to the skin over a large area. By means of the capillary bed of the skin, there is an absorption of the radiant energy and the warm blood is carried to other portions of the body. Fever as a result of pathologic conditions is produced from sources entirely within the body, and is devoid of heat elimination.

Reaction in Fever Therapy. — There are several types of reactions which may occur as a result of fever treatment, but their occurrence has been decreased considerably by gained knowledge and experience. Restlessness is not uncommon, but can be controlled by sodium amytal given before and by codein, morphin, or dilaudid, during treatment.

Abdominal cramps, nausea, and vomiting, which accompany treatments by hot air cabinets or diathermy, have been minimized by the use of 500 cc. of a 10 per cent glucose solution given intravenously in a saline medium,

as recommended by Desjardins. It is well recognized that tetany is likely to occur in prolonged fever therapy. It is particularly observed in the cabinet method with an unusually high environmental air temperature (140-150 degrees F.). "Hot air to the skin stimulates respiration to such an extent that definite alkalosis is produced." (Stecher.[42]) This condition is easily remedied by the intravenous administration of 10 cc. of calcium gluconate.

We have records of our results of over 350 treatments using electromagnetic induction by sustained fever of 105 degrees F. for a period of five hours. These we consider very favorable: No tetany, no prostrations occurred; no cramps or other evidence of abdominal distress caused discomfort; and only two cases of nausea were observed. One of these vomited. Only two cases of fever blisters were caused by the treatment; one was mild and soon disappeared, while the other necessitated suspension of treatment for a month.

Summary and Conclusion

1. A comparison of malaria therapy with electromagnetic induction has been made. Evidence is at hand that hyperthermy through physical methods is superior to fever produced by foreign proteins. Though the results obtained may be equal to those of the physical methods, the hazards by foreign proteins make physical procedures a method of greater safety. The advantages of the physical methods are:

a. They are always available.

b. The frequency, duration and the high elevation of temperature can be produced in most cases and kept under accurate control.

c. Chemotherapy can be used with pyretotherapy when desired.

d. No pathologic diseases are introduced.

2. Through the use of artificial fever in gonococcal arthritis, 92 per cent of the cases are completely relieved. In bone changes no improvement can be expected other than relief of pain and sterilization of the joint. Fifteen to twenty per cent of atrophic arthritis cases show permanent improvement, though fever treatment should not be used to the exclusion of general treatment. Hypertrophic arthritis evidencing bone changes shows no marked improvement.

3. As the gonococcus is the only microorganism whose lethal rate has been determined, the most favorable results have been obtained in its infections.

4. The value of aseptic, controlled fever therapy as an adjunct to chemotherapy in the management of neurosyphilis is now definitely established.

5. The ability of trained personnel is of great importance in the production of artificial fever.

6. Fever therapy in the treatment of disease is still in the experimental stage, except in neurosyphilis and gonococcic infections, where it has gained recognition as an effective method.

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FEVER THERAPY IN GONOCOCCAL ARTHRITIS AND EPIDIDYMITIS *

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It has been said of artificial fever, particularly that induced by heat cabinets and similar devices, that it is too hazardous considering the comparative mildness of gonorrhea. Disregarding for the moment the therapeutic measure, let us consider the disease as to its assumed mildness. It is not a fatal disease, but when we study the effect of gonorrhea, we can arrive at no other conclusion than that it is a widespread, serious, loathsome disease, and a prominent factor in causing disability, suffering, and great economic loss. A disease so classified, demands that we study exhaustively every form of therapy that offers a reasonable chance of decreasing the ravages it has produced in every walk of life. In therapeutic fever we have a method which presents an opportunity for study as well as a reasonable chance for success. Many have carefully tried and investigated the various agents for producing fever, and at present, as a result, there exist well developed plans and procedures for conducting such fever therapy. Some accidents have occurred in the past, but we believe that with the accumulation of more experience, treatments are comparatively safe and justified in the management of gonorrhea.

For therapeutic fever induction, we, at the U. S. Marine Hospital, in New Orleans, have used the Kettering Hypertherm since June 1, 1934. It has proved a highly effective means of inducing and maintaining fever in a patient at a desired level. The general plan in gonorrheal infections is to elevate the temperature to a point between 106 degrees and 107 degrees F., and to maintain this fever for five hours. A two-day rest is given between treatments as a rule. Occasionally a patient who has become too debilitated because of a chronic gonococcal arthritis is subjected to fever not higher than 105 degrees F., with longer rest periods between treatments. These cases in our experience have been relatively uncommon.

In carrying out our work, the following general procedure is in effect in order to minimize accidents and to attain the best possible results.

1. All fever treatments are given in an air conditioned cabinet known as the Kettering Hypertherm.
2. All physicians and nurse technicians supervising the treatments have received intensive training before being permitted to conduct this work.
3. Patients who are to be subjected to fever treatments are carefully examined and none are treated who have renal, cardiac or cardiovascular defects.
4. The nurse technician is constantly in attendance throughout the treatment. Each patient receives the same consideration as one who is to have a major operation.
5. Warnings of impending disaster during the treatment are always promptly heeded and proper measures are instituted or the treatment is discontinued, if necessary.

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* Read at the meeting of the Southern Section, American Congress of Physical Therapy, New Orleans, March 23, 1936.

6. All patients subjected to fever therapy are hospitalized during the entire course of treatment. It might be possible in most cases to hospitalize the patient for the day of the treatment only, but we feel that he has been subjected to a treatment sufficiently strenuous to keep him constantly under immediate care.

Clinical Results

Although we have treated patients for various conditions in the Kettering Hypertherm, the far greater number of cases had gonorrhea. Since June 1, 1934, 238 patients have received 1,383 fever treatments with a total of 6,915 hours. Of the 238 patients, 174 were treated for gonorrhea and its various complications. No fatalities have occurred in any of our cases. Since the vast majority of the beneficiaries of the Marine Hospital are males, we are able to present only studies completed in male patients. We have selected particularly, cases of arthritis and epididymitis because these were the most frequent disabling complications presented to us for treatment.

Sixty-five cases of gonorrhea complicated by acute epididymitis were given treatments in the Kettering Hypertherm. Thirty-five of these patients had involvement of the left epididymis. Twenty-six had involvement of the right epididymis and in four, a bilateral complication existed. Thirty-eight of these cases were complications of acute gonorrhea and twenty-seven of chronic gonorrhea.

The results of fever therapy in epididymitis were most gratifying, in that after the first treatment there was marked to complete relief of pain and swelling in sixty-three of the sixty-five cases. A few of these had slight soreness until after the third treatment. An occasional case had slight soreness and swelling until after the fourth or fifth treatment. Swelling was a bit slower in disappearing and usually required approximately one more treatment to clear up than was necessary for causing disappearance of pain. Two of the sixty-five cases had unsatisfactory results in clearing up the epididymitis for the following reasons:

After six treatments in one patient there was still some swelling of the epididymis. Patient requested discharge from the hospital.

There was relief of pain and swelling after each treatment in another case, but there was a recurrence of pain and swelling before nearly every treatment. This recurrence was due, no doubt, to the fact that this patient could not be kept quiet between treatments. He was finally discharged from the hospital because he insisted on being away from hospital between treatments.

Of the sixty-three other patients, forty-five obtained complete relief of the associated urethritis and other gonorrheal complications — usually as a result of additional fever sessions. Of the forty-five cases who were completely cleared of all gonorrheal infection, the average number of treatments were slightly in excess of five. Eighteen still had some evidence of gonorrheal infection for the following reasons:

Twelve were not adequately treated for the reason that the patients themselves believed they were well and therefore did not remain for more treatments, or they were discharged from the hospital because it was necessary for them to leave the city.

Treatment was stopped in six, because after having reecived from eight to thirteen sessions there seemed little hope that the remaining urethritis would clear up.

Twenty-five patients with acute gonococcal arthritis were treated. Of these nine were complications of chronic gonorrhea and sixteen were complications of acute gonorrhea. Seventeen had more than one joint involved. The

frequency with which the various joints were involved in this group were as follows: One hand in 1; both hands in 2; one wrist in 3; both wrists in 1; both elbows in 3; both shoulders in 2; one hip in 3; both hips in 2; one knee in 8; both knees in 6; one ankle in 8; both ankles in 2; one foot in 1; and both feet in 2.

The remaining eight had one joint involved: knee in 3; wrist in 2; elbow in 1; shoulder in 1; and sternoclavicular in 1.

The results of the treatments in the twenty-five were as follows:

16 recovered completely.
5 were markedly improved.
4 were moderately improved.

Fifteen patients with chronic gonococcal arthritis were treated. Of these, four had involvement of one and eleven more than one joint. Of the four with monoarticular types, the joints were the knee in two, and the hip in two.

In the eleven who had polyarticular arthritis, the joints involved were: One hand in 1; both hands in 1; one wrist in 1; both wrists in 1; one elbow in one; one shoulder in 1; one sternoclavicular in 1; one cervical spine in 1; one hip in 2; both hips in 2; both ankles in 4; one foot in 1; both feet in 5.

The results of the treatments in chronic gonococcal arthritis were as follows: Ten patients recovered completely, three were moderately to markedly improved and two were improved, but later had a return of their symptoms.

In both the acute and chronic cases an average of nearly eight fever treatments was given per patient. Possibly it was unnecessary to give this many, as the average is higher than that given for any other gonorrheal condition. There was usually marked relief of pain and swelling in the first one or two treatments and a continued gradual decrease thereafter, so that by the completion of the fifth treatment the patient was quite comfortable. However, it was our procedure that when stiffness and slight swelling persisted, additional sessions were given until the joints had recovered completely or until no appreciable improvement could be noted from treatment to treatment. It is quite likely that other measures as massage, local heat, exercises, and the like would have cleared up the residual symptoms very readily. We cannot, of course, hope for complete relief by fever therapy where partial ankylosis has taken place. Orthopedic treatment is indicated in these cases.

In the arthritic group there was more success in clearing up the associated gonorrheal conditions; largely, no doubt, this was due to the fact that the arthritis reminded the patient for a longer time than did epididymitis, that he had gonorrhea and for that reason most of this group remained for treatment until discharged. Twenty-two out of the twenty-five patients with acute arthritic complications and fourteen of the fifteen with chronic arthritic complications, recovered completely from the associated urethritis, prostatitis, epididymitis or other evidence of gonorrheal infection.

Case Reports

There are reported herewith four cases to give an indication of what can be accomplished with fever therapy:

Case 1. — D. C., white, male. Gave history of gonorrhea since July 26, 1935. Urethritis gradually decreased on local treatment but was still present on September 6, 1935, on which date he first noticed soreness in left epididymis.

By September 13, 1935, the testicle was the size of a large orange and was extremely painful. He had a slight urethral discharge which was positive for gonococci. One fever treatment was given on September 13, 1935, and on the following morning the testicle was reduced two-thirds in size and was painless, and on the second day

after the treatment it was normal in size. The urethritis had cleared up completely. He was examined repeatedly thereafter and no evidence of gonorrhea was found.

Case 2. — S. F., white, male. Onset of gonorrhea September 27, 1935. Treated himself with local injections. On October 5, he developed severe rectal pain. He had difficulty in passing urine and had bleeding at end of micturition. On the following day his right epididymis began to swell and by October 9th it had reached the size of a large orange and was very painful. The prostate by this time also was very large and painful. Urethral smear was positive for gonococci. He was given seven fever treatments between October 9, 1935, and October 29, 1935. The bleeding at end of urination stopped after the first treatment and virtually all pain in the prostate and epididymis had disappeared. The epididymis returned to normal size after three treatments and the prostatitis and urethritis cleared up completely after the sixth treatment. This patient was seen as late as February, 1936, and had no recurrence.

Case 3. — G. C., white, male. Gonorrheal urethritis about January 1, 1935, which cleared up in a few days. About March 15, the left knee began to swell and became painful. On March 20, 1935, the knee was quite swollen and painful. Fluid taken from the knee that day was positive for gonococci. Fever therapy was instituted and six treatments were given. He had early relief of pain and gradual decrease in size of the joint. After the sixth treatment he still had some stiffness of the joint. This persisted until June 15, 1935. Six months later he was examined again, the knee was still normal and there was no evidence of urethritis.

Case 4. — G. R. C., white, male. History of gonorrhea beginning October 6, 1934. On November 25, 1934, he began to have pain and swelling of both hands and knees. Swelling and pain became severe. Urethral smear was positive for gonococci.

He was given thirteen fever treatments between December 6, 1934, and February 28, 1935. When he left the hospital after the last treatment he had no urethral discharge and all joints were normal. He has been examined repeatedly since, and was last seen on November 27, 1935, at which time he had no recurrence of arthritic symptoms or urethritis. Working.

Comment

Hench[1] recently tabulated the results of fever therapy in acute and chronic gonococcal arthritis as reported in the literature and at the recent Fever Therapy Conference. One hundred and fifty-one cases of acute arthritis were reported; 80 per cent were considered cured; 10 per cent had marked relief, and 10 per cent had moderate relief to little or no improvement. Thirty-two cases of chronic arthritis were reported, with 70 per cent obtaining marked relief to complete recovery, 15 per cent moderate relief, and 15 per cent little or no relief.

Hench[2] also summarized the cases of epididymitis presented at the Fifth Annual Fever Conference. Only forty-four cases were reported and classified as excellent.

Despite the fact that fever therapy seems very promising as an aid in the treatment of gonorrhea, there still exists some disagreement as to some phases of its management. For instance, there are now several plans with reference to the length of the fever sessions as carried out by various workers. We will summarize a few of these briefly. It is likely that better standardization will be attained after these and other methods have been given a more extensive trial.

The first plan is that of giving one session. Boak, Carpenter and Warren,[3] studied the thermal death time of 130 strains of gonococci *in vitro* and found that at 106 to 107 degrees F., the thermal death time varies from 6 to 27 hours. Their plan, therefore, is to culture the organism from each patient, and to determine the thermal death time of the gonococcus. The patient is then given one fever treatment at 106 degrees to 107 degrees F., for a time, slightly in excess of the thermal death time of the gonococci found *in vitro*. None of their patients was given a session longer than seventeen hours. Excellent results were obtained in most of the cases so treated.

In those where the thermal death time was longer, correspondingly long treatments were not practical; yet despite this, the results were uniformly good, demonstrating that the individual was able to supply certain defense measures as a result of stimulation by fever.

A second method is that in use at the Mayo Clinic. Desjardins, Stuhler, and Popp,[4] recently outlined the plan of their fever sessions as follows:

Two test sessions with two day intervals are given at a temperature between 106 degrees and 107 degrees F., for six hours. The patients are then examined for urethral and vaginal discharge. If no discharge is found, and if the smears and culture are negative for gonococci, two additional fever treatments of the same length and at the same temperature are given. Again there is a two day interval between treatments. In the event, however, that after the first two test sessions there exists a urethral or vaginal discharge, or if smears or culture are positive for gonococci, an additional fever treatment is given at 106 degrees to 107 degrees F., for eight hours. If this still does not prove adequate, another treatment is given at the same temperature for ten hours and possibly repeated at two day intervals for one or two more treatments. Generally such long treatments are not necessary.

The third plan is the one which is in most general use at present, and is the one we employ at the U. S. Marine Hospital. This consists of elevating the patient's fever to between 106 and 107 degrees F. for five hours and repeating this treatment until the individual is well or until it is decided that continued treatment will result only in failure. The interval between treatment is two days.

A fourth method of fever therapy advocated by Bierman and Levenson.[5] They combine focal heating with general fever. The treatment consists of elevating the fever to 105.5 degrees F. for five to six hours, and at the same time by means of vaginal or rectal electrode in females, and a rectal electrode in males, the pelvic temperature is elevated to 111 degrees F. for three hours in females and three to four hours in males.

As one considers the reports of the various methods, one notes that all offer some advantages. Time will help us to determine if any one method is best, or if all may have their place in this therapy.

In conclusion, we emphasize again, as we have done many times before, that the study of fever therapy in gonorrhea is really only in the initial stage, but despite this, it seems to have a definite place as a therapeutic method. Many workers have reported excellent results, which substantiates our own encouraging results.* However, we must allow time to help us in sifting out our errors and judging more accurately our final results. Then only, will we arrive at the proper evaluation of this form of treatment.

210 State Street.

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* Appreciation is expressed to Senior Surgeon, W. H. Slaughter, U.S.P.H.S., for his assistance and advice in this work; to Senior Surgeon T. B. H. Anderson, U.S.P.H.S., and Passed Assistant Surgeon R. C. Arnold, U.S.P.H.S., who started this work in the U. S. Marine Hospital, New Orleans, and conducted much of the work reported herein; to Lula Nicholson, Nell Davis and Helen Jarboe, nurse technicians, for their excellent care of the patients.

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HYPERPYREXIA IN BRONCHIAL ASTHMA *

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Brief reference to the writings of Feinberg, Osborne and Afremow,[1] Rackemann,[2] Berg,[3] Holst,[4] Miller and Piness,[5] Leopold and Stewart,[6] Cameron[7] and of other authors reveals a uniform and common observation, that fever associated with infectious diseases often temporarily and occasionally permanently controls the symptoms of allergic disease. Closer study of these contributions reveals with the same uniformity, the opinion that to attempt to produce this febrile reaction in allergic people by foreign protein, malaria, relapsing fever, would be both impracticable and dangerous.

These two views have been chiefly responsible for the pioneer work in hyperpyrexia produced by physical means in this group of diseases and especial attention has been focused upon bronchial asthma. In this pioneering I have shared somewhat personally and as a result of this experience offer a report which we feel in some respects will tend to dampen the over enthusiastic and at the same time encourage some of the early workers who, after first attempts, gave up the method as a failure.

It is little short of an imposition to burden busy clinicians with pages of descriptions of technic, apparatus and theories, when they are fully covered in the extensive literature. Some have used bakers and electric blankets, others high frequency, short wave, radiotherapy; still others, conditioned air cabinets. In the main all ascribe their results to the fever and not the method. In this opinion I do not by any means concur, my reasons having been set down elsewhere.[8]

Many of the original developers of this application to the treatment of bronchial asthma have since abandoned it as being not worth while. A wide personal contact has, on the other hand, revealed what doubtless is an unjustified overenthusiasm on the part of more recent workers. What is the reason for such a wide divergence of opinion? The answer, which, of course, is a call for arbitration, appears to be supplied by clinical and physiologic evidence. I am unaware of any work except my own that has introduced into research scientific rules of control, three of which will be seen to be of basic necessity in dealing with bronchial asthma. These rules involve (1) a sufficiently large number of patients including their variations of age, sex, type, and duration; (2) a prolonged period of controlled observation and, (3) a detailed study of both clinical and biologic reactions, both immediate and subsequent. These and other control factors have been rigidly observed. My first report[9] covered fifty cases studied over a period of six to eight months. My second report[10] increased the number to one hundred and prolonged the observation period to between twelve and eighteen months. At present I have for record over two hundred and fifty cases with an observation period ranging from six months to three years for the original or first group. In the group are practically all ages, varying from four to seventy-two years, and both sexes are about equally represented. All types and durations are well represented from the standpoint of chronicity, allergy and pathology. Extensive clinical and biologic studies have been carried out, the details of which have already been published[8-9-10] and examples of which are shown in the accompanying tables and graphs. The cases were divided into

* Read at the meeting of the Southern Section, American Congress of Physical Therapy, New Orleans, March 23, 1936.

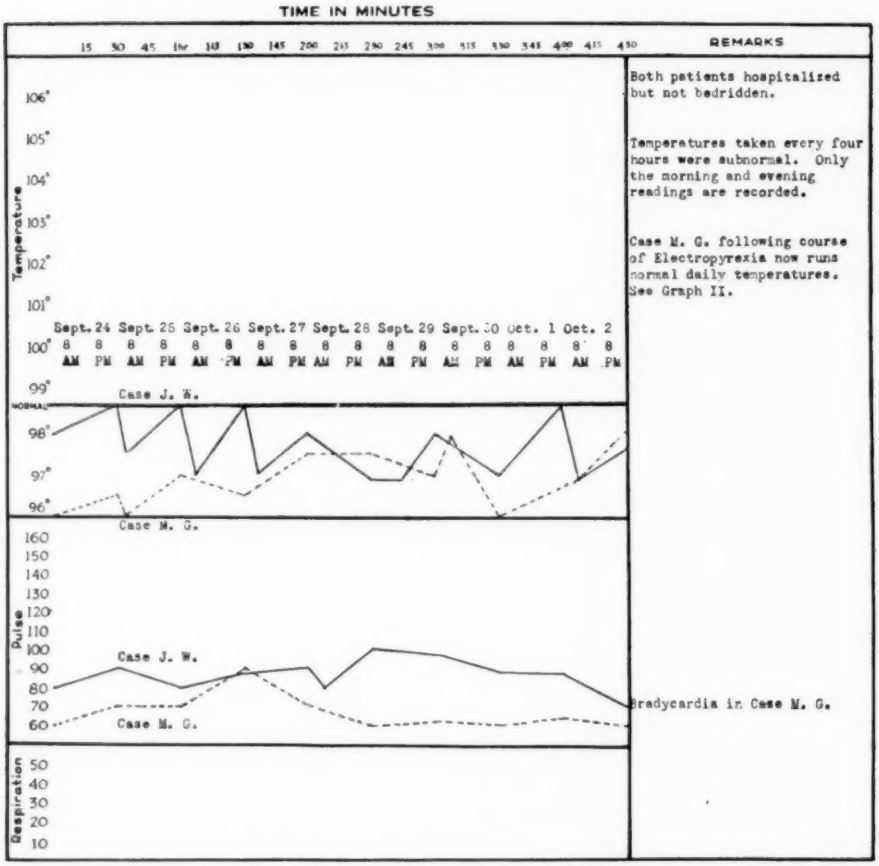
TIME IN MINUTES
REMARKS
Both patients hospitalized but not bedridden.
Temperatures taken every four hours were subnormal. Only the morning and evening readings are recorded.
Case M. G. following course of Electropyrexia now runs normal daily temperatures. See Graph II.
Temperature
Sept. 24 Sept. 25 Sept. 26 Sept. 27 Sept. 28 Sept. 29 Sept. 30 Oct. 1 Oct. 2
Case J. W.
Case M. G.
Pulse
Case J. W.
Case M. G.
Bradycardia in Case M. G.
Respiration

Fig. 1. — Subnormal daily oral temperatures in two cases of bronchial asthma, hospitalized for nine days. Temperatures were taken every four hours.

several groups for the purpose of testing the comparative value of the various levels of temperature, hyperpyrexia as a sole therapeutic program versus hyperpyrexia combined with other measures, the number of treatments required, the interval between treatments and other factors concerned with the development of a proper working program.

At this point it would seem desirable to state the general conclusions ahead of the discussion upon which such an opinion is based. My results definitely indicate that fever therapy by physical means as a specific in the treatment of bronchial asthma will be disappointing and of no value except as a temporary measure, especially for breaking up an acute paroxysmal attack. On the other hand when used in conjunction with other measures, it becomes one of the most valuable adjuncts in therapy.

In order to properly evaluate hyperpyrexia in the treatment of bronchial asthma we must view the affection from the standpoint of clinical physiology and metabolic changes. Such a view gives us the reason why the individual is allergic, because physiologic and metabolic processes are disturbed. Table 1 and figure 1 outline summaries demonstrating in ten cases some of the outstanding abnormalities of normal physiologic constants. This general picture of low metabolism characterized by dry, non-functional skin, autonomic imbalance, low blood pressure, tendency to subnormal temperature, hypoglycemia, low basal rate, subnormal gastrointestinal, liver, endo-

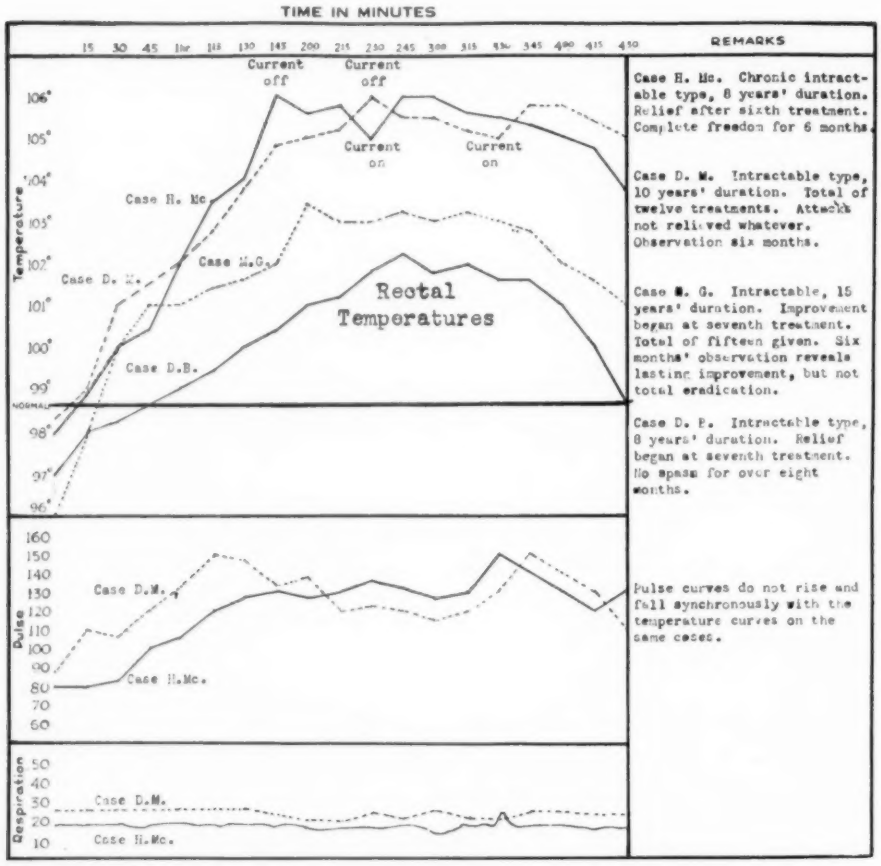
TIME IN MINUTES
REMARKS
Current off
Current on
Case H. Mc.
Case D. M.
Case M.G.
Case D.B.
Rectal Temperatures
Temperature
NORMAL
Case D.M.
Case H.Mc.
Pulse
Respiration
Case H. Mc. Chronic intractable type, 8 years' duration. Relief after sixth treatment. Complete freedom for 6 months.
Case D. M. Intractable type, 10 years' duration. Total of twelve treatments. Attacks not relieved whatever. Observation six months.
Case M. G. Intractable, 15 years' duration. Improvement began at seventh treatment. Total of fifteen given. Six months' observation reveals lasting improvement, but not total eradication.
Case D. B. Intractable type, 8 years' duration. Relief began at seventh treatment. No spasm for over eight months.
Pulse curves do not rise and fall synchronously with the temperature curves on the same cases.

Fig. 2. — Production and maintenance of higher and lower temperature levels in four cases of bronchial asthma.

crine and kidney functions are so common and constant in bronchial asthma that our experienced nurses and laboratory technicians recognize them with comparative ease. Detailed discussion of these factors are far beyond the scope of this paper but they are discussed in articles[11-12] already published.

With this general picture in mind, hyperpyrexia aims directly at restoring the deficient metabolism to normal and not at allergy or hypersensitivity, one of the symptoms. We appreciate that as a specific, hyperpyrexia will be of little value but as an adjunct a most valuable measure. Why is this? Because we can hardly expect bouts of fever alone or in series, although they do temporarily raise metabolism, to cure a case where physiologic and metabolic processes are reduced by a suppurative ethmoiditis, gastrointestinal or endocrine disturbances, all of which are so common in asthmatics. On the other hand when it is used in conjunction with other measures it serves as one of the most reliable adjuncts to insure rapid recovery. Within the past year the press has publicized various new measures as revolutionary cures for bronchial asthma. This may be interpreted as the beginning of recognition of asthma as a clinical symptom demanding correction.

Asthmatics are inherently low in some form of resistance (immunogens). The classic treatment for the past quarter of a century has been directed at desensitizing or raising this deficiency. There are some determining factors we use as guides to this property in all diseases. We know that when cir-

culation to a local part or to all parts is increased, oxidation is improved, metabolic exchange stimulated and other things being equal biochemical processes are improved. We have been taught to look upon the blood stream as vital and to measure its component constants to guide us during sickness.

Tables 1 and 3 show a marked constant increase in basal metabolism, a constant rise in leukocytes, improvement in urinary total acidity, hypoglycemia and retention of acid base balance as a result of hyperpyrexia.

TABLE 1. — *Deviation from Normal Physiologic and Metabolic Constants in Ten Cases of Bronchial Asthma*

Patient	Avg. Daily Oral Temp. Degrees	B M R	B P	Mg. Blood Sugar	Urine 24 Hours					Skin Apearance
					Gas Acid F.	Gas Acid Tot.	Total Deg. Acid	Sp. Gr.	Urea Grams	Indican	
H.M.—25—Male	97.6	—12	85/50	87	0	15	90	1026	12	++	Dry, scaly, sallow
P.M.—35—Female	96.8	—10	90/60	90	5	12	65	1015	14	+	Dry, icteric, thick
J.W.—37—Male	96.6	—15	87/40	85	0	10	110	1030	8	++	Dry, eczematoid
M.M.—18—Female	97.8	—12	108/70	87	0	6	102	1020	10	++++	Dry, thickened, scaly
M.G.—54—Female	96	—18	102/70	85	5	15	90	1025	12	++	Dry, sallow, thick
M.B.—29—Female	97	— 6	98/60	92	10	18	62	1024	14	+	Slight moisture
D.B.—7—Male	98	+ 2	90/55	85	....	....	102	1018	8	+	Dry, eczematoid
G.S.—8—Female	98	+ 2	90/60	87	....	....	64	1010	8	+	Dry, eczematoid
M.N.—10—Male	96.8	—10	85/50	85	....	....	72	1008	12	0	Dry, scaly
B.L.—16—Male	97	—12	88/55	87	2	12	80	1016	10	0	Dry, eczematoid

These reactions indicate improvement of general biochemic and metabolic processes as a result of hyperpyrexia (table 2). Their value in bronchial asthma lies in correcting the low metabolic picture. Hyperpyrexia was used as the sole treatment in 57 patients, 65 per cent of whom revealed a distinct improvement for six months. Following this period, some began to manifest recurrence, until at the end of eighteen months there were only ten per cent who apparently were relieved, up to the present writing. It must be added that gross pathologic states were present in many of these, but were not treated because they were used as controls. Table 3 shows the maintained acid base balance in various diseases as measured by recognized standards. Bierman[13] especially has given us valuable food for thought in this connection in his elaborate discussion of lactic acid behavior.

Summarizing the entire subject we have come to regard hyperpyrexia in bronchial asthma as a most valuable adjuvant in conjunction with other methods for correcting existing physiologic and clinical abnormalities. At first we produced and maintained high temperatures for long periods, but later we utilized lower temperature maintained for four to five hours (figs. 2 and 3). We were soon able to establish that at least ten treatments, weekly or biweekly, must be given for any lasting results. As time has passed and our observations expanded, we have noted the value of lower temperatures, shorter intervals and more frequent treatments. Case D. B. (table 4) illustrates a striking example of two years chronicity. His treatments were shortened and continued up to a total of thirty-five, and in the third year he demonstrated an almost spectacular, rapid improvement. It, therefore, becomes evident that first reports appearing in the literature covering one or two cases who received one to three treatments each are of no

TABLE 2. — *Biochemical Changes During and After One Course of Hyperpyrexia in Nine Cases of Bronchial Asthma*

		Blood Counts			Blood Chemistry					Urine	
Patient		R. B.C.	W. B. C.	Eos.	Sugar—Mg.	Urea—Mg.	Alv. CO_2	Alk. Res.	S. G.	Urea—Mg.	Total Acidity—Deg.
H.M.—Male	Before	4,200,000	4,000	6	57	16.5	30	8.4	1017	12	27
	Height	4,800,000	9,400	5	87	12	20	8.2	1012	....	8
	After	4,800,000	9,500	4	95	12	25	8.2	1016	20	26
B.L.—Female	Before	4,800,000	7,600	10	80	20	45	8.6	1018	14	50
	Height	5,200,000	20,100	6	98	16.5	45	8.2	1003	....	10
	After	4,700,000	11,500	4	104	12	25	8.4	1018	18	18
E.M.—Female	Before	3,530,000	8,800	9	78	22	45	8.3	1013	10	18
	Height	4,500,000	11,400	5	96	16	45	8.3	1008	....	4
	After	4,800,000	9,000	7	102	12	45	8.2	1015	18	16
J.B.—Male	Before	3,960,000	9,400	14	90	23	25	7.6	1018	12	52
	Height	4,500,000	12,600	5	97	18	25	7.8	1003	....	5
	After	5,050,000	10,200	6	102	16	30	8	1025	20	18
R.J.—Female	Before	4,270,000	10,600	7	98	18	45	8	1019	10	34
	Height	5,130,000	14,100	5	107	14	45	8.2	1023	....	23
	After	6,120,000	11,200	6	106	10	45	8.4	1016	16.5	22
R.W.—Male	Before	2,800,000	8,600	14	72	21	35	7.8	1021	8	72
	Height	3,130,000	11,500	6	87	16	30	7.6	1017	....	20
	After	3,500,000	9,200	7	92	14	30	7.6	1017	16.5	11
B.L.—Male	Before	3,960,000	5,050	10	87	16.5	30	7.6	1021	14	33
	Height	4,000,000	11,400	7	96	13	30	7.8	1009	....	5
	After	3,900,000	9,300	7	97	11	20	8.2	1016	18	18
B.O.—Female	Before	4,270,000	4,500	20	68	18	30	7.8	1018	12	22
	Height	5,120,000	9,500	13	82	14.5	30	8	1013	....	17
	After	4,260,000	6,900	16	102	12	30	8.2	1016	18	15
R.M.—Male	Before	4,440,000	10,600	16	82	20	45	8.4	1019	10	....
	Height	4,800,000	14,100	13	98	15	45	8.2	1022	....	....
	After	4,300,000	8,800	16	106	15	45	8.2	1016	16.5	....

conclusive value. It is not surprising that some of these men have abandoned hyperpyrexia as worthless. I am at present observing a group in which the temperature is elevated to only 101 or 102 degrees F. for forty-five minutes daily. The present indications are that this technic might prove

TABLE 3. — *Biologic and Metabolic Changes Resulting from Hyperpyrexia in the Normal State and in Various Diseases*

Diagnosis	Ratio	B. M. R.	B. P.	Temp.	Plasma Ph	Plasma CO_2	Ionic Cal.	Plasma Chl.	R. B.C. Chl.	Sweat	
Normal	98.6	7.35	66	2.2	361	172	0.48	.....	.....	.....	.....
	104	7.42	64	1.9	361	162	0.45	.....	.....	.....	.....
Hyperarthritis	98.8	7.36	58	2.5	343	175	0.50	.....	.....	.....	.....
	104	7.42	54	2.3	350	173	0.49	.....	.....	.....	.....
Inf. Arthritis	100	7.38	56	2.5	344	173	0.50	.....	.....	.....	.....
	105	7.41	49	2.6	344	164	0.48	.....	.....	.....	.....
Normal	98.6	.....	.....	.....	.....	.....	.....	+12	90/68	P.H.	Cl.224 mg.
	104	.....	.....	.....	.....	.....	.....	+52	92/50	7.22	
Bac. pyelitis	98.8	.....	.....	.....	.....	.....	.....	+ 1	110/70	Sugar	Urea
	103	.....	.....	.....	.....	.....	.....	+25	110/58	27 mg.	23 mg.
Diabetes Mellitus	99.6	.....	.....	.....	.....	.....	.....	—12	110/58	Sugar	.....
	102	.....	.....	.....	.....	.....	.....	+ 1	106/50	Trace	.....

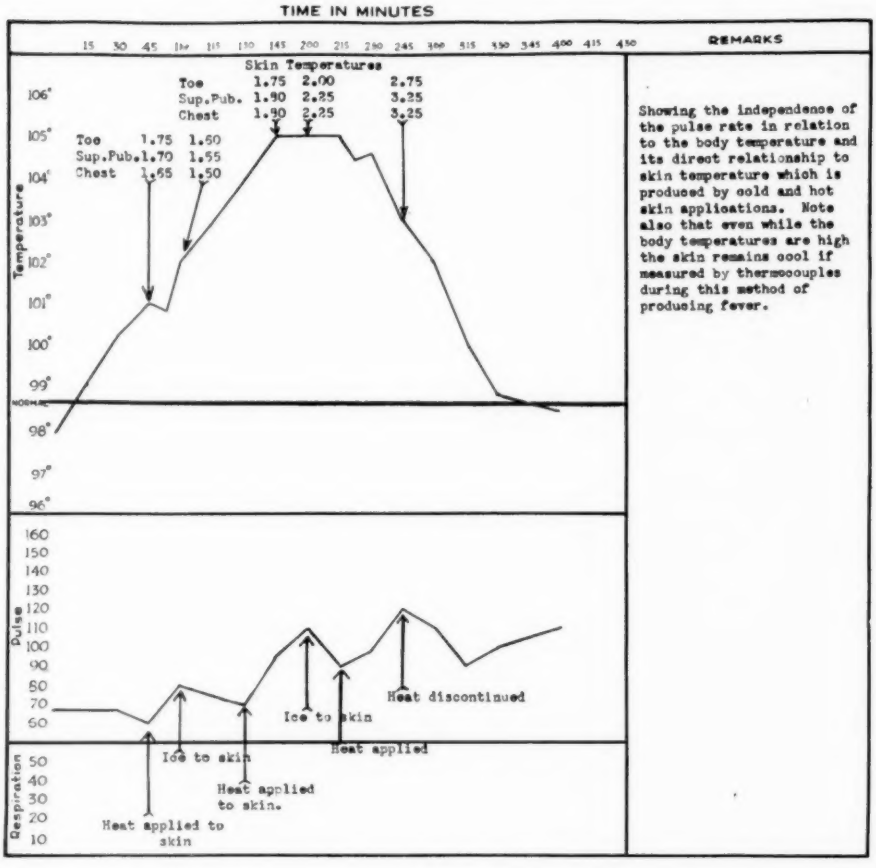
TIME IN MINUTES
15 30 45 100 115 130 145 200 215 230 245 300 315 330 345 400 415 430
REMARKS
Skin Temperatures
Toe 1.75 2.00 2.75
Sup.Pub. 1.90 2.25 3.25
Chest 1.90 2.25 3.25
Toe 1.75 1.60
Sup.Pub. 1.70 1.55
Chest 1.65 1.50
Temperature
106° 105° 104° 103° 102° 101° 100° 99° NORMAL 98° 97° 96°
Showing the independence of the pulse rate in relation to the body temperature and its direct relationship to skin temperature which is produced by cold and hot skin applications. Note also that even while the body temperatures are high the skin remains cool if measured by thermocouples during this method of producing fever.
Pulse
160 150 140 130 120 110 100 90 80 70 60
Heat discontinued
Ice to skin
Heat applied
Ice to skin
Heat applied to skin.
Heat applied to skin
Respiration
50 40 30 20 10

Fig. 3. — Independence of the pulse rate to the body temperature and the direct relationship to the skin temperature.

TABLE 4. — *Temperature Peak, Maintenance, Number of Treatments and Progress of Ten Cases of Bronchial Asthma Treated by Hyperpyrexia*

Pt.	Type and Duration	Temp. Peak	Duration in Hours	No. of Treats	Results and Remarks
D. M. Age — 35 Female	Intractable, constant, with severe exacerbations. Ten years. Adrenalin fast.	105°	Five	10	Treatments aggravated attacks. No relief following 4 mos. Suggestion of improvement at end of 6 mos. At end of one year return of bronchospasm. No improvement by treatment.
B. L. 16 Male	Intractable, constant exacerbations eight years.	105°	Four	10	No improvement for 2 months, then marked gradual improvement, no spasm for past 90 days. At end of 16 mos. some recurrent attacks but less severe than before treatment.
H. M. 46 Female	Chronic, intractable, constant 20 years.	106°	Five	3	Stopped treatment. No improvement.
B. M. 18 Male	Chronic, periodical every three weeks. Two years.	104°	Three	10	Complete relief at eighth treatment. No return in 8 months. One slight attack at 11th month. No others. Still free at 18 months. Return of attacks in milder form during second year.
M. G. 53 Female	Constant, intractable, severe, 30 years.	104°	Three	15	Relief almost complete during day. Some spasm at night, requiring 3 min. adrenalin for comfort. Four mos. observation. No further improvement at end of three years.

(Table 4—Concluded)

L. T. 10 Male	Chronic, periodical attacks every 10 to 14 days.	104°	Four	10	Complete relief for 4 mos. Eight mos. observation. One slight attack during 13th month. None since, 18 months observation. Entirely free at three years.
D. B. 7 Male	Intractable, constant since two years of age.	104°	Two	35	Complete relief for 4 mos. Recurrence of attack less severe than old form. No improvement at 18 month. Marked improvement during third year.
E. W. 36 Female	Acute, periodical, duration, six months.	103°	Four	10	No brochospasm in eight months. No recurrence at end of thirty months.
M. N. 10 Male	Chronic, periodical. Four years	106°	Four	15	Complete relief for three months, followed by light attack. No spasm for past 3 months. Periodical recurrent attacks at end of 14 months, less severe. Continued improvement thirty months.
G. S. 8½ Male	Chronic, periodical. Four years.	106°	Four	15	Partial relief only at end of four months. Hypopituitary type. Tonsils infected. Father and mother are first cousins. Return of asthma in original form at 10 months. No relief at two years.

to be the most appropriate. With this method one can treat cases ambulatorily and increase the total number of treatments indefinitely to fit individual needs. At these temperatures general oxidation and metabolism is enhanced, and the patient is hardly inconvenienced. At any rate these observations tend to show that we have only scratched the surface of the therapeutic possibilities of hyperpyrexia.

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Discussion

Dr. J. K. Howles (New Orleans): There is still need for much fundamental, scientific investigation in this branch of therapy, for the "fever-machine business" has become so highly commercialized that often the claims from such sources are distinctly at variance with the scientific facts. This "ballyhoo" has been aided, I am sorry to say, by over enthusiastic members of our profession. It would seem that we are becoming too much concerned with machines, and neglecting the fundamentals behind this therapeutic measure. Fortunately, keen observers like Wagner von Jauregg and his disciples have since proved that the destructive and degenerative process due to the effect of fever was in part imaginary. After years of critical observation of the result of fever in cases of dementia paralytica, von Jauregg, in 1917, proved that artificially induced fever could be used in the treatment of that seemingly hopeless infirmity. It has been a short step from the original evidence of the therapeutic value of fever to the present development of mechanically induced fever. Without endeavoring to extol the value of any particular kind of "fever machine," I have found pyretotherapy, especially that form induced by "fever machines" almost indispensable in the treatment of certain types of central nervous and systemic syphilis. I refer to those syphilitics who do not respond or cannot tolerate the usually effective chemotherapeutic measures.

Although it is generally agreed that the early cases of neurosyphilis offer the best prognosis, we, unfortunately, cannot always select our cases and many far advanced neurosyphilitics are encountered. Even though our hope of cure in these far advanced cases is nil, we still strive to make them more comfortable and to prevent them from becoming public charges by arresting the progress of their disease.

We have treated 33 advanced cases of neurosyphilis with induced fever within the last year. Pyretotherapy has been used as a last resort in those in whom no other form of therapy was of benefit. A careful physical examination and laboratory tests, including blood chemistry and complete blood count was made on each of these patients. The cases chosen for this form of therapy were of syphilitics of the following types: 1. Optic atrophy cases which could not tolerate tryparsemide; 2. C. N. S. cases which showed no response to tryparsemide or Bismarsen therapy; 3. C. N. S. cases which showed no response to malaria therapy followed by chemotherapy. All thirty-three cases were treated with combined fever and specific therapy. Bismarsen and saturated solution of potassium iodide or sodium iodide was given in conjunction with the fever. The intervals between treatments varied from twice weekly to once every two weeks. The number of treatments given and frequency of treatments depended upon the individual tolerance of the patient. Only one fatality resulted and it could not be wholly attributed to the fever therapy.

Our clinical results from electromagnetic induction were more impressive than with an equal number of malaria cases used as a control. Our serological reverse to normal in both the spinal and blood were more rapid than in the malaria cases. We consider fever induced by electromagnetic induction a safer and slightly superior method of hyperpyrexia treatment than that usually produced by malaria.

Dr. John S. Coulter (Chicago): The preceding essayists have critically evaluated the limitations and possibilities of hyperpyrexia by physical agents. It is noted that Dr. Giles states that fever therapy is still in the experimental stage except in neurosyphilis and gonococcic infections. Under the circumstances it is important to stress the contraindications already mentioned. Hyperpyrexia by means of physical agents is only safe when it is given in a hospital after a complete physical and laboratory examination under expert medical and technical supervision. At Northwestern University we did not secure as good results in the treatment of asthma as Dr. Phillips did, hence our Asthma Clinic is not continuing its use. With reference to the use of fever therapy with air conditioned cabinets I should like to ask Dr. Trautman if he has determined if its high temperature has had any effects in sterilizing patients so treated. Experiments at the University of Chicago with high external temperatures have shown a very definite and deleterious effect on the normal function of the testicles.

Dr. Kenneth Phillips (closing): Dr. Coulter emphasized three important points. Fever therapy is a hospital procedure, although there is a surprisingly prevalent opinion that it can be utilized as an office procedure, which, in my opinion is dangerous. I have wondered many times regarding the possibility of sterility resulting from these high temperatures. I think the skin temperature during the fever plays an important rôle in this connection. I wish to reëmphasize that our results in bronchial asthma were not encouraging when fever alone was used. When employed in conjunction with other measures fever is valuable.

Dr. John Trautman (closing): The need for careful management of fever treatments cannot be too strongly emphasized, since deaths have occurred from such treatments. Probably some changes in technic may aid in decreasing accidents. We can only answer Dr. Coulter's question concerning sterilization of patients treated with fever by saying that we have no work to report.

Dr. Upton Giles (closing): Our procedure in producing artificial fever has followed closely the original work of

Neymann and Osborne. While finding their methods effective, we occasionally have resorted to other means of inducing fever. We employed several ways; namely, the conductive, the convective and the conversive methods. One method was an incandescent-light cabinet, the degree of heat being controlled by socket switches. We found that maintaining febrile temperatures of 105 degrees F. for several hours produced symptoms of heat stroke. We therefore soon discontinued the use of cellotex cabinets. Lately, Atsatt and Patterson of the Santa Barbara Cottage Hospital, as well as Bishop, Warren and Lehman, have advocated the incandescent-light method in preference to all others.

The induction of high fever by electromagnetic fields having been developed, we soon followed the lead of others in using a large canvas bag of the zipper type, thus enclosing the patient to prevent heat loss. The use of induced short waves and by means of the cable, pancake-coil, and Kimball Cabinet, afforded us the simplest and safest way of any method used. The pathologic reactions of fever, such as abdominal cramps, nausea, vomiting, tetany, headache, and vasomotor collapse do not occur when this method is used within the range of fever adopted.

Lately there is a tendency to permit the production of artificial fever in homes and in physicians' offices. It is not my purpose to determine the method and the place where artificial fever be induced, but we should realize that, at best, the patient is infrequently brought to the border-line of disaster. It is therefore evident to me that when temperatures of 105 to 106.7 degrees F. are maintained for several hours, there must be constant medical and technical supervision.

Asthmatic cases in our hands have received little benefit from fever therapy.

Regarding the questions propounded by Drs. Phillips and Coulter relative to high environmental temperatures in air-conditioned cabinets producing sterility in the male, we are unable to give any information; but our experiments with animals proved that sterility is produced when the incandescent light cabinet is used. We have set a definite time for the culmination of our observation. Then we will make a final report as to the refuctioning of the generative organs.

PHYSICAL THERAPY IN LOW BACK INJURIES *

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Lower back injuries are among the most common encountered by the industrial surgeon. Even with the help of mechanical devices, much work remains to be done by the individual, the back receiving its share of the labor. Lifting is probably the most frequent cause of back injury. It is often due to the workman being placed in an awkward position, lifting at heights and lifting heavy loads, in spite of caution against these hazards.

Back injuries are sustained also in auto accidents, by falls, severe strains and sudden jerks, which upset the proper balance and equilibrium of the individual. Awkward steps and direct violence are other not uncommon causes.

Before discussing the symptoms and treatment consideration should be given to the anatomy of the lower back and the natural variations of these parts which occur in otherwise normal individuals. The sacroiliac joint is the part most often affected while sciatic nerve injury plays an important rôle.

Anatomic Considerations

The sacroiliac joint is formed by articulation of the sacrum and ilium. In close proximity is the fifth lumbar vertebra. The articular surfaces are covered with hyaline cartilage and are held together by extensive ligaments. The anterior and posterior sacroiliac ligaments stretch across the front and

* Read at the meeting of the Southern Section, American Congress of Physical Therapy, New Orleans, March 23, 1936.

back of the joint from sacrum to ilium. The posterior ligament is the stronger and is powerful, while the anterior is weak. The iliolumbar ligament extends almost horizontally laterally from the tip of the tranverse process of the fifth lumbar vertebra to the inner tip of the crest of the ilium. The sacro-tuberous ligament is attached medially to the posterior, inferior iliac spine and to the posterior surface of the transverse process and sides of the third, fourth and fifth sacral and coccygeal segments. This ligament passes distally and laterally to its attachment on the medial side of the tuberosity of the ischium. The sacrospinous ligament is a triangular one attached by its base to the lateral margins of the sacral and ischial spine. Thus the joint is vulnerable from four directions in regards to its ligaments, and from two directions in regards to its cartilage, which may account in a measure for so many painful backs.

The lower back while well protected by bony structure, is not so well protected by ligaments and muscles. Its ligaments and soft tissues are subject to strain due to the peculiar position of the sacroiliac joint. This joint supports the weight of the trunk and also absorbs the shocks from the lower extremities. It holds the key position when one is lifting, bending, stooping and walking. It maintains equilibrium and balance and compensates for any awkwardness or undue strain inflicted either by the trunk while lifting or by the lower extremity when walking.

Symptomatology

As this paper deals with conditions due to trauma, history of an injury should be deduced. The nature and extent of the injury should be detailed; whether pain was acute necessitating cessation of work, or whether soreness developed some time after the trauma. These facts have some bearing on the treatment.

Prominent symptoms are pain in the lower part of the back and limitation of motion. The pain may radiate along the spine, the sacroiliac joint and down the thigh. If a fracture exists there may be seen or palpated, a deformity of the spinal column. Roentgenograms in both the anteroposterior and lateral positions should be made, and if no gross pathologic condition is found, a closer scrutiny should ascertain if a deceptive linear fracture is present or irregular cartilaginous surface markings exist.

Cases without fracture show tenderness on palpation and limited motion. The patient may not be unable to stand in the erect position. The weight of the body thrown on one leg thus favors the injured side. Bending the body either forward, backward, or laterally aggravates the pain. The patient while standing cannot raise either leg to a normal position, losing his balance sufficiently to require support. If sacroiliac strain is present it will be found that the pelvis is twisted, so to speak, to the affected side. With the patient in the recumbent position, it is not difficult to determine a difference in the length of the legs.

In severe cases, even without fracture, there may be present some general symptoms such as shock, exhaustion, labored breathing, excessive sweating, irritability and nervousness. However, the most constant symptoms are pain and limitation of motion.

Examination of Patient

The proper examination of the patient is of much importance. All clothing should be removed to give a good view of the general contour of the lower back region. Any abnormality of the spinal column should be observed. The patient should place his own hand on the tender or sore part.

Palpate along this for deformity or muscle spasm. The patient is requested to stand erect if possible and then bend forward, backward, and laterally to either side. Either leg is raised to maximum, after which a recumbent position on a table is assumed. Grasp the legs at the ankles to see if both internal maleoli are even. In a severe sacroiliac strain, one leg will appear to be longer than the other. By actual measurement with tape line from the anterior superior spine to the internal maleolus both legs will be equal in length, but by placing the feet together one will be from a half to three inches longer than the other.

The patient now should be turned over on his face and a minute inspection made of the back. Palpate the spine and search for any malalignment of spinal column. Also palpate the muscles of the back to ascertain any tender points of the soft tissues and along the sciatic nerve down the thigh. Any suspicion of a fracture should promptly call for roentgenograms of the spine. To be of value both anteroposterior and lateral views should be made. The films should be examined for minute details. Often with the aid of a magnifying lens a lineal fracture may be found, which otherwise would easily be overlooked.

Management

The treatment of lower back injuries will depend on the gravity of the lesion. If fracture of any bone is discovered, it will have to be dealt with in the orthodox manner; probably a cast of some form of traction, or merely adequate rest in bed after which physical measures will hasten a satisfactory end result.

Fortunately for both the doctor and the patient, the majority of lower back injuries show no bony injury. For these physical therapy is of greatest value. In the recent or acute cases the commonest form of treatment is some form of heat and infrared irradiation is preferable. Heat should be applied for at least forty-five minutes to an hour. Then gentle massage to the back is indicated after which a snug strap of adhesive tape is applied. Advise the patient to remain in bed for a few days to promote healing; then repeat this same treatment every two or three days until patient is well. In stubborn cases other measures must be employed. Diathermy, manipulation and massage are of value and give much comfort to the patient.

Reduction of Deformity

There are several ways to manipulate the back to reduce deformity if it exists. First, the patient may be placed on the abdomen, both hands of the operator placed on the ilium and force applied in the direction of reduction. Another way is to place the patient on the side and do a "shoulder ilium" reduction. Still another way is to have the patient lie on a table face downward and support himself on his elbows and abdomen, his hands gripping the edges of the table securely. The operator should stand on a box or platform built for the purpose, at the feet of the patient, and firmly grasp the patient's ankles and lift the body clear of the table, the body being supported on patient's elbows alone. While in the position have an assistant make firm pressure over the sacrum. The body of the patient is lifted up and down several times, making traction on the legs at the same time. Then apply adhesive straps snugly across the back from ilium crest to ilium crest and down the back on the buttocks with a level of both great trochanters.

Still another maneuver is to have the patient lie on the back with an assistant to hold the "shorter" leg to the table so as not to bend the knee. The operator then takes the "longer" leg, flexes it on the thigh, the thigh

on the abdomen, and with one hand lifts up the tuberosity of the ischium at the same time that the leg is in the extremist flexion. Then slowly bring the leg down in abducted rotation, to the other leg on the table. If this last maneuver is carried out correctly both legs will be the same length. These reductions are always made after the application of heat which relaxes the tissues rendering reduction easier. A belt made of two or three strips of truss elastic sewed together and made to fasten in front with buckles which fit snugly about the pelvic girdle is very comfortable. Truss elastic is pliable enough to allow some movement of the body, but will serve to hold the pelvic girdle with a minimum amount of motion.

When some patients do not readily respond to any of the mentioned methods of treatment, look for some complication in the form of focal infection of the teeth, tonsils, sinus, gall bladder, intestinal tract, prostate or syphilis, especially the latter, for any of these can certainly prolong a back injury. Others such as faulty posture and bad foot trouble tend to aggravate the condition. These are purely orthopedic cases and must be treated as such.

As an aid to physical measures or until such a time as physical measures may prove effective, the salicylates may be essential, especially for their analgesic action. The administration of drugs is definitely indicated to control acute symptoms such as pain; while the combination of drugs, physical procedures, massage, hydrotherapy and manipulation should produce prompt and effective results.

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TECHNIC OF PHYSICAL THERAPEUTIC METHODS IN GYNECOLOGY *

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MINNEAPOLIS

Among the various physical therapeutic measures that have come into vogue within the last few years for the treatment of gynecologic conditions, are the use of ultraviolet in gonococcal cervicitis and urethritis, heat in various pelvic disorders, particularly pelvic inflammatory disease, and the utilization of electrothermic coagulation in leukorrhea based on persistent cervical and endocervical infections that are not amenable to ordinary topical treatment. I shall endeavor to summarize briefly some of the work that has been done in these fields and the results that are being achieved with these various methods of treatment.

Ultraviolet in Cervicitis

The first type that I shall discuss is ultraviolet in the treatment of gonococcal cervicitis. A survey of the literature shows that the work that has been done with this agent is very minimal. Van de Velde states that he has obtained his best results with ultraviolet in the treatment of rather super-

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 10, 1935.

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ficial, easily accessible lesions, particularly in chronic inflammations. He states that non-malignant erosions of the cervix that do not yield to other forms of therapy heal rapidly with the use of ultraviolet. He also cites good results with this therapy in such conditions as tuberculosis of the cervix, ulcers on a prolapsed cervix, and in certain types of eczematous lesions of the labia, perineum and mons veneris.

Engelhorn, Landeker, and Kleeman have stated that the indications for ultraviolet therapy in gynecology are erosions of the cervix, leukorrhea, decubital ulcers on a prolapsed cervix, and gonococcal cervicitis and urethritis.

Bremesfeld has treated a series of 150 cases of cervicitis and observed a marked improvement in all. He gave his patients three exposures weekly, each treatment lasting from 15-30 minutes. It is necessary to remember that the length of time involved in the treatments by Bremesfeld was necessitated by the fact that he was not using modern types of cold ultraviolet generators.

Flaskamp, Behneman and Negley, have had good results with this treatment in inflammatory conditions of the vagina and erosions of the cervix.

The authors cited above include practically all of the work that has been done on this particular phase of treatment.

I have treated to date 91 cases of gonococcal cervicitis with ultraviolet. These patients when first seen showed in practically every case a profuse purulent cervical discharge with marked erosion and eversion of the lips of the cervix. There was present in most cases an associated urethritis. These patients were told not to take douches during the course of treatment so that we could be the more certain of the amount of discharge actually present and thus note whether or not improvement resulted from the treatment.

Preparatory Treatment

The vagina and cervical canal were first swabbed clean with cotton. Because of our very unsatisfactory experience with the use of Dobell's solution or hydrogen peroxide to dissolve the thick, tenacious cervical mucus we changed to the vegetable digestive ferment derived from the plant Carica papaya. A cotton applicator is placed in this powder and then carried to the cervical canal. Within 45 seconds the mucus plug has been entirely digested and liquefied and the cervical canal cleansed.

Following this cleansing the cervical canal and any erosions are painted with 10 per cent silver nitrate. The orificial applicator is then inserted into the canal to the internal os and treatment given. All cases were started with a one and a half minute exposure. The length of time of the exposures was rapidly increased to ten minutes with no ill effects. It was found however, that an exposure of three minutes was just as effective clinically as the longer treatments.

With few exceptions, after four or five treatments the cervical smears rapidly became negative with no subsequent positive findings. The amount and character of the discharge rapidly changed from the profuse purulent type to normal. Following the development of a normal discharge the patients were put on rests from treatment up to three months. Upon returning for a check-up preliminary to dismissal, all cases showed a normal cervical secretion, at least three negative smears and no clinically suspicious symptoms.

It was found that in cases showing a marked and extensive erosion of the cervix, the effect of ultraviolet was not as rapid in curing the erosion as in stopping the discharge. In our attempt to heal these erosions as rapidly as possible, cases not healing after several ultraviolet treatments

were cauterized with the electrocautery. The results of this treatment not being entirely satisfactory we changed to the Cherry technic of cervical coagulation. The results with this method were much more satisfactory. In every case the end result was a healing of the lesion. Patients were treated three times weekly with ultraviolet, twenty treatments having been the average number necessary. There were noted no ill effects from the treatment although five of the cases had a small amount of bleeding each time following the removal of the applicator. Several of the patients also complained of uterine cramps during the treatment, but these were not constant and did not affect the results obtained.

For the sake of comparison I have reviewed the charts of 70 patients who had been treated for gonorrhea by the usual routine methods at one of our free dispensaries. It was found that the average patient was treated twice weekly and that the average length of time that these patients were under treatment was 18 months. It can thus be readily seen that the results with ultraviolet are much better not alone from the standpoint of the patient, but also from an economic point of view.

I do not agree with Negley that ultraviolet alone will cure all cases of erosion and discharge, but I do feel that used in conjunction with other physical therapeutic methods ultraviolet is a valuable addition to our gynecologic armamentarium.

In a recent personal communication from Dr. Gordon Rich, of New Zealand, who employed this method of treatment shortly after having read my preliminary report on it, published one year ago, he tells me that he has used the method with success and feels that it is a distinct advance in treating gonorrhea in the female.

I would like to cite a rather typical case history.

Patient 33 years old, teacher, past history and menstrual history are essentially negative. Her present complaint started in October, 1933, as a greenish discharge with a chafing and itching of the vulva. She had no urinary or rectal symptoms.

Examination revealed that the external genitals were markedly reddened and irritated and that there was a profuse purulent vaginal discharge. There was marked redness and inflammation of the cervix with a rather extensive erosion. Uterus and adnexae were negative. Repeated cervical smears were positive for the gonococcus. This patient was treated by the usual routine methods for about six months, with some relief of symptoms and a healing of the eroded area. The inflammation and irritation of the vulva disappeared. The cervical discharge however, persisted despite treatment, making it necessary for the patient continually to wear a vulvar pad. The discharge was apparently arising from the cervical canal and was not responding to treatment. This patient was then treated with ultraviolet. After eight treatments the discharge practically disappeared, and the patient was apparently cured of her infection after a total of 18 treatments with no recurrence to date — eighteen months after discharge.

Electrocoagulation of Cervix

Another form of physical therapy that I feel can be used to great advantage in gynecology is electrothermic coagulation of various types of cervical lesions, aside from those arising as a result of gonococcal infection, as previously mentioned, those lesions resulting in leukorrhea for which we have no other form of specific therapy. This type of treatment will, I feel, soon supplant many of the operative methods that are used to remove infected cervical tissue. The particular advantages of coagulation are that the technic can easily be acquired, there is no disability, no loss of time, and there is a distinct financial saving to the patient.

Moensch summarizes the advantages of coagulation over cauterization in chronic inflammatory diseases of the cervix. He states that coagulation produces less heat in the vagina, is more easily controlled, that there is less

risk of injury to the parts surrounding the cervix with no distracting odor of burning flesh, the resulting slough separating more easily with less tendency to secondary hemorrhage and stenosis of the cervix. After extensive use of the method I agree with him in all of his statements. Cherry has used the method with extremely satisfactory results and has produced an electrode that has advantages over the Kimble-Jaros instrument.

Mikels, of Los Angeles, states that coagulation is the most conservative method for the treatment of cervical lesions and that it is the best method in his experience for treating chronic erosions and infections of the cervix, and in preventing the occurrence of cancer of the cervix.

Dunlap, Wilmoth, Grant Ward, and a number of other clinicians have state their preference for this treatment in published reports.

Roblee of St. Louis goes a step further in the use of the coagulation treatment of the cervix. Roblee uses a small flat curved knife blade and by using sufficient cutting current to give the knife mobility within the cervical tissue, does a modified Sturmdorff operation on the cervix, gouging out and mass coagulating a conical area of diseased cervix. Roblee had good results in 94 per cent of his cases. I feel that this mass coagulation of the cervix is indicated only in those cases that we would otherwise operate on by the Sturmdorff procedure. I feel that for the type of case that we ordinarily deal with the simple Cherry technic of coagulation is sufficient and gives the best results. Roblee states that he has an incidence of primary hemorrhage of .03 per cent and secondary hemorrhage of 3.4 per cent following his method. I have seen no hemorrhages, either primary or secondary, following the Cherry technic.

Thermotherapy in Gynecology

The last method of treatment that I shall discuss is the use of dry heat in the treatment of pelvic inflammatory disease.

It is well known that infections of the female pelvis and their various sequelae cause a high percentage of chronic invalidism among women. In the last few years there has been a definite trend toward conservatism in the treatment of these conditions and the use of heat today plays an important part in the reduction of the operative incidence. I shall not go into a detailed review of the literature of the subject, but shall confine myself to a brief review of the opinions of a number of the more prominent men who have investigated the possibilities of this form of therapy.

Holden and Gurnee, of Bellevue Hospital, reported 500 cases in which heat was used by the Elliott technic in both acute and chronic pelvic disease with excellent results.

Graham, Jacobs, Vaughan and Gellhorn reported good results with this method particularly in gonococcal salpingitis, and also in postpartum and postabortal infections.

Holden and Sovak reported the use of heat as being beneficial both pre- and postoperatively in cases of pelvic inflammatory disease. They state that preoperative treatment reduced the magnitude of operation and made the tissues easier to work with.

Counsellar, of Rochester, has used this treatment in all types of pelvic inflammatory disease. He reports satisfactory results in about 75 per cent of his series.

Aside from the use of diathermy in applying heat, there are two other methods. The so-called Elliott method utilizes a bag filled with circulating water, the pressure and temperature of which can be regulated. The second method is one in which the applicator is made of metal and contains a heat-

ing unit built into it, the temperature of which is regulated by a rheostat. This latter method of treatment is not as widely used as the former for unknown reasons.

I first learned of this technic of applying heat a year ago at the last session of this Congress, where I saw the instrument demonstrated. Before that time I had been using the Elliott apparatus. I decided to use it because of its simplicity and to see whether or not it would give the same results as the bag method. I have used it for the last year and find that both give the same end results. I do not feel that it is necessary to distend the vagina; the heat is absorbed by the pelvic tissues in a sufficient degree whether or not this distension is accomplished. Beyond the questionable advantage of vaginal distension by the bag, it is my opinion that the simpler the method the more universally will it be used and for that reason I favor the latter method of applying heat to the pelvis. I do feel however, that the applicator could be modified by making it larger and so increasing its heat radiation.

In both methods it is important to protect the introitus against the heat coming through the applicator, because the external parts cannot stand the temperature that the vaginal tissues and pelvis can tolerate. This is accomplished by wrapping in a small towel or by covering with wet gauze the part of the applicator that lies between the labia. This is usually sufficient to make the patient comfortable. It is also necessary that the vaginal tract be examined regularly during the course of treatment; a number of cases of burns following treatment have been reported.

Results of Thermotherapy

I have treated 52 cases with this method of applying heat with extremely satisfactory results. Pelvic inflammatory masses in 38 of these cases disappeared entirely, leaving the patients free of symptoms; in 7 cases the size of the masses was diminished and the patients stated that they experienced some relief of symptoms, in the remainder the effect of the heat was negative as far as symptoms were concerned, and the inflammatory masses remained the same in size.

From my limited experience with this method I would say that more than 50 per cent of cases of gonococcal pelvic inflammatory disease that we previously have considered as surgical, can be treated by this method with a good prognosis as regards relief of pain and disability and a return of the pelvis to a near normal state. The method of treatment certainly deserves a trial.

Patients are treated daily, starting with a temperature of 120 degrees F. for 30 minutes, the temperature is rapidly elevated to tolerance, which is around 125 to 135 degrees, in a few days, and the length of treatment increased to one hour. Patients should receive at least 15 treatments as a course. The metal applicator used can be sterilized by boiling. I would also like to cite here a typical case.

Mrs. E. S., age 22. First seen August, 1932, at which time patient was pregnant. She was delivered of a normal female infant in March, 1933. At that time her past history was negative. In January, 1934, this patient returned with a history of backache, pain in both lower quadrants and profuse vaginal discharge and a history of having contracted gonorrhea from her husband. This patient was hospitalized for two weeks because of her symptoms and the fact that she had an acute pelvic inflammatory disease with bilateral adnexal masses the size of oranges. After discharge from the hospital she was treated with ultraviolet and her cervical and endocervical infection disappeared, smears became negative and she had no further discharge. Her pelvic symptoms, however, persisted as did the pelvic masses. She had to go to bed several days every few weeks because of pain. This patient was given 15 daily heat treatments of one hour each. At the end of the course the pelvic masses had entirely

disappeared with the exception of a very slight induration in the right adnexa. She has since had no recurrence of disability, and states that she has felt well. This is the kind of case that I feel would have come to operation if it were not for the type of treatment that she had received.

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TREATMENT OF PNEUMONIA BY ELECTROMAGNETIC INDUCTION

Preliminary Report

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This report presents the histories of four cases of pneumonia typical of the results obtained with the application of electromagnetic induction according to the technic to be described.

This technic is the outcome of several years of clinical research in establishing the determinants of adequate dosage of electromagnetic induction and diathermy. Adequate dosage is determined by the intensity of current, duration of each treatment, and frequency of treatments, which will safely establish and maintain an effective active hyperemia. A definite technic cannot be offered, as it must be adapted to each individual case. It is essential to take into account the pathologic state of pneumonia as well as the general condition of each patient at the time of each treatment. It is not rational to treat a lobar pneumonia, a bronchopneumonia, a postoperative pneumonia, or a hypostatic pneumonia by a routine technic. One must vary the dosage even during the course of an individual case. In lobar pneumonia, to illustrate, we have the stages of acute congestion, red and gray hepatization, and resolution, and each of these stages must be treated differently. This requires clinical judgment, and is obviously the task of a physician that cannot be delegated to a technician.

In my experience the efficacy of prolonged and frequent applications of the electromagnetic induction in the treatment of pneumonia lies in the employment of a low intensity. I have never used more than 60 and in some cases as little as 20 per cent of the output of the apparatus in the treatment of pneumonia. The specific effects of dosage in the individual case is evident in the reports presented; and these examples clearly show that a standard procedure cannot be adopted as a routine.

Case Histories

CASE 1.—Mrs. C. T. Age 31. Diagnosis: Onset of lobar pneumonia. Resumé: The patient is a slight person about 4 ft. 10 in. tall and weighs 98 lbs. She has never been physically strong and has been under medical supervision for secondary anemia associated with a glandular dyscrasia for the past three years.

The present illness began when the patient awakened at 4:00 A.M. with a severe chill which lasted about an hour and was followed by fever. The fever endured throughout the day and her physician was summoned that evening. At 8:00 P.M. the rectal temperature was 103.6 degrees F.; the clinical picture was one of acute respiratory infection; medical management was instituted. The next morning the patient had another severe chill, developed pleuritic pain, and coughed up a bloody sputum. At noon on the second day the temperature was 104.2 degrees F. and the chest showed signs of acute congestion. The patient was transferred to the hospital by ambulance immediately and electromagnetic induction treatment begun. The clinical course is shown in the accompanying graph (chart 1) and the objective improvement followed the charted improvement directly. The patient was ambulatory during the last two days in the hospital and free from all objective and subjective symptoms other than a moderate general weakness.

At the top of the graph are some heavy vertical lines; each of these indicates an inductothermy treatment of two hours duration, one hour anteriorly and one hour posteriorly. Application was made by means of the 12-inch disc electrode. The patient was

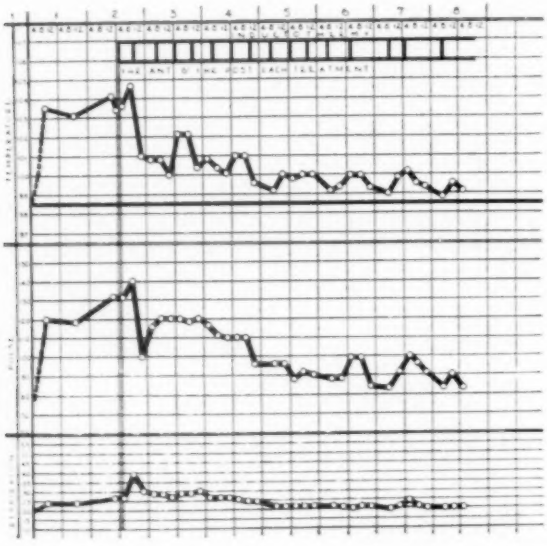

Fig. 1. — Rectal temperatures recorded in case 1; Mrs. C. T.; Age 21; diagnosis, onset of lobar pneumonia.

given four hours of treatment in the first twelve-hour period; three two-hour treatments each day for three days; two two-hour treatments each day for two days; and one two-hour treatment on the last day.

During the first 24-hour period the temperature dropped 4.6 degrees F., the greatest decline occurring during the second treatment. This is of importance in that it indicates that the intensity used was not sufficient to increase the body temperature or even prevent its decline despite the fact that the patient felt very much warmer during treatment and perspired profusely. Body temperatures were taken before and after each treatment and in no case did the temperature rise more than 0.6 of a degree.

Treatment began 36 hours after the onset of the first chill during the stage of acute congestion, and 60 hours after the initiation of electromagetic induction the patient ran a consistently normal temperature. The pulse and respiration improved with the decrease in temperature, as shown in the graph.

Of particular interest is the fact that relief from pleuritic pain, cough, dyspnea, and anxiety occurred during the first 12 hours. The regularity of the treatment by electromagnetic induction in this case was dictated by the patient's condition, but this should not be interpreted as a standard procedure.

Case 2.—Mrs. D. G. Age 22. Diagnosis: Lobar pneumonia. Resumé: Two weeks prior to the present illness the patient had a slight cold with coughing and moderate pain in upper chest on deep breathing. This condition cleared up in three days.

The present illness began with a slight chill and fever. On the second day another chill occurred and a higher fever together with pleuritic pain and a blood streaked sputum. On the third day a physician was called and he suspected a beginning pneumonia and instituted medical management. At this time the temperature was 103 degrees F. orally, which is the first observation on the graph. On the fourth and fifth day the condition became progressively worse and there was a beginning consolidation in the right lung. The physician then brought the patient to the hospital for electromagnetic induction. The accompanying graph shows the subsequent course (chart 2). The relief from pleuritic pain was complete in the first six hours; the dyspnea and anxiety were also relieved. The extreme anxiety of the patient was occasioned by the fact that she believed she was going to die and leave her seven month old infant motherless. Her anxiety was so pronounced that it added greatly to the general exhaustion and prostration. This is of importance in that it interfered with the ease of application of electromagnetic induction and made advisable the use of a lower intensity than could have been used if the pathologic condition in the chest had been the only determinant of dosage.

In this case two two-hour treatments were given in the first twelve hours; three two-hour treatments during the next day; two two-hour treatments each day for the next four days. The greatest symptomatic relief was experienced

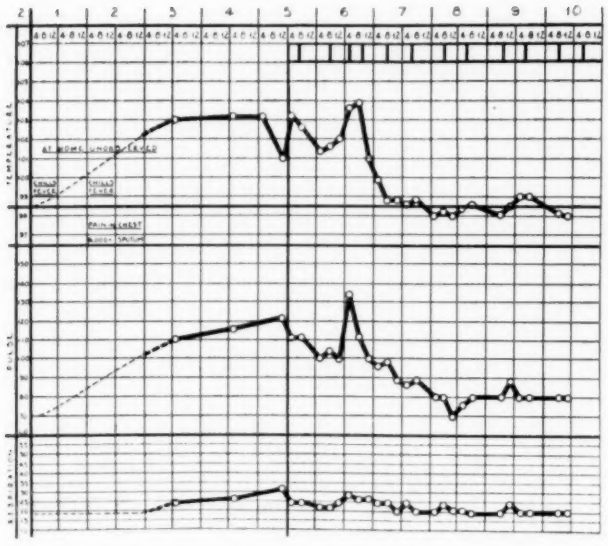

Fig. 2. — Oral temperatures recorded in case 2; Mrs. D. C.; age 22; diagnosis, lobar pneumonia.

during the first eight hours. The greatest clinical improvement became manifest during the second 24-hour period under treatment, the temperature dropping 5 degrees in twelve hours.

In less than 48 hours after the beginning of electromagnetic induction, the temperature of the patient became normal and remained so. At the time the patient was discharged the chest was clear on physical examination, except for a small amount of expectoration each morning.

Case 3. — F. M. Age 8. Diagnosis: Bronchopneumonia. The illness began with an abdominal onset and fever. The first symptom was abdominal cramps, and within an hour a fever developed and vomiting occurred. These symptoms became progressively worse for

Fig. 3. — Rectal temperatures recorded in case 3; Master F. M.; age 8; diagnosis, bronchopneumonia.

two days, at which time a diagnosis of acute appendicitis was being considered. After consultation it was decided that the child be kept under observation. During the following 24 hours the abdominal symptoms abated and signs of severe congestion appeared in both lung fields; a definite bronchopneumonia was then evident. During the next few days the patient's condition became progressively worse and on the 7th day of the disease, (the 5th in the hospital) as indicated on chart 3, it was regarded critical. The family was advised that the prognosis was unfavorable, and electromagnetic induction was decided upon. The result is shown in the graph.

It is interesting to note that during the first eight hours the patient's temperature dropped 5.4 degrees F., during which time four hours of electromagnetic induction had been given. A coincident drop in the pulse and respiratory rate was noted. Thirty-two hours after initiation of electromagnetic induction the patient had the beginning of a continued normal temperature. During this time, ten hours of electromagnetic induction were given. Treatment was continued for four days after the beginning of the normal temperature in order to promote resolution of the pathologic areas. Each vertical mark at the top of the graph indicates a 2-hour treatment of electromagnetic induction, one hour anteriorly and one hour posteriorly, each time. The intensity used varied from 20 during the first treatment to 50 per cent of the output of the electromagnetic induction during the later treatments.

The improvement of this patient was remarkable; after 32 hours the patient enjoyed complete comfort and after four days all physical findings were normal. It is especially significant that electromagnetic induction produced this result in bronchopneumonia.

Case 4. — R. M. Age 46. Diagnosis: Post-operative pneumonia. Resumé: The patient had a gangrenous appendix removed. Several days later an abdominal wound abscess was opened and drained. During the remainder of the first week the usual recovery ensued. On the morning of the 9th day he had a chill followed with fever which continued to rise for 36 hours, reaching 103.6 degrees F. orally. A radiograph showed an early lobar congestion in the middle lobe of the right lung. During the next few days extension to the entire lower lobe of the same lung was noted. The condition became progressively worse and the patient was becoming very toxic and prostrated. On the evening of the 13th day (the 5th day of pneumonia), I was consulted, and electromagnetic induction was started immediately (11:00 P.M.). During the first 24 hours of the treatment period the patient became exceedingly toxic, despaired of life, and begged us to stop the treatment. After considering all clinical data it was our judgment that inasmuch as the temperature, pulse, respiration, and physical findings were no worse and even seemed a little better, the toxic prostration was due to the liberation and absorption of toxins as a result of the active hyperemia produced by electromagnetic induction. It was decided to continue treatment. An adequate fluid intake was provided, since it is of paramount importance during the period of greatest toxicity to promote the rapid elimination of toxins. The next morning brought our reward. From 8:00 P.M. to 8:00 A.M. the temperature dropped from 102 to 98.6 degrees F. On this morning it was very gratifying to the physician to see a new man sitting up looking over a stack of mail, after having had a bath, a shave, and a good breakfast.

In following the graph we see that the temperature rose to 100 degrees that afternoon, down to normal the next morning, and up to 99.6 in the afternoon. On the 17th day (the 9th day of pneumonia), there began a consistently normal temperature. We note that the pulse and respirations followed the temperature improvement. Thirty-two hours after the beginning of electromagnetic induction we observed the first normal temperature and after another 48 hours the temperature remained normal.

The first treatment was given from 11:00 P.M. to 1:00 A.M., due to the fact that consultation was held at 10:00 P.M. Twelve hours delay in beginning the treatment might have changed the course and prognosis greatly. I am of the opinion that it is just as important to treat a pneumonia at midnight as it is to operate for acute appendicitis at that hour. The second treatment of two hours was given from 8:00 to 10:00 A.M. The third treatment began at 2:00 P.M. and was terminated after 20 minutes on account of the prostration of the patient. The fourth treatment of one hour was given from 9:00 to 10:00 P.M.;

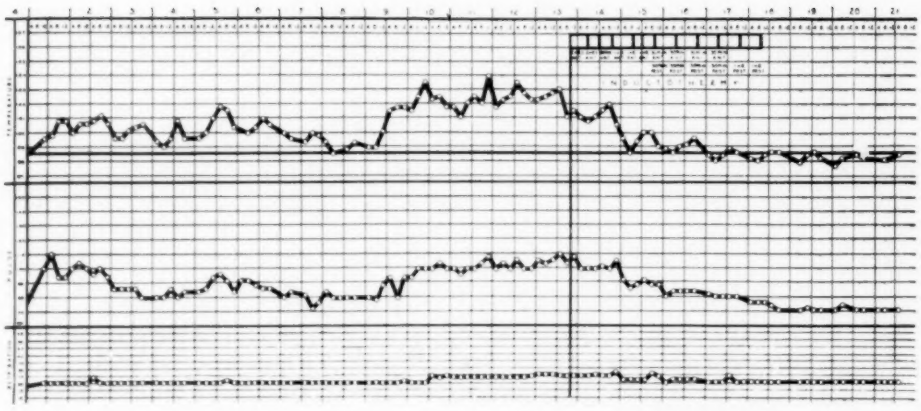

Fig. 4. — Oral temperature recorded in case 4; Mr. R. M.; age 40; diagnosis, postoperative pneumonia.

this too was as much as seemed advisable at that time. The next day one hour treatment was given in the morning and again in the afternoon. All of the treatments given until now were applied to the chest anteriorly. In the evening we gave 30 minutes application anteriorly and 30 minutes posteriorly. This divided dosage was used in a like manner for the next three treatments. The last two treatments were given posteriorly only. By applying the treatment posteriorly we mean that the patient is turned over so that the posterior chest wall is uppermost. This is not required for the adequate application of the treatment, but is of advantage in that this change of posture favors the disappearance of the hypostatic congestion in the posterior portion of the lung. In this case the physical findings of pneumonia were most persistent in the posterior part and therefore the latter treatments were given entirely posteriorly. The reason for not using this change of posture during the first six treatments was that the exhaustion and prostration contraindicated moving the patient.

The intensity used ranged from 20 at the beginning to 50 per cent of the output of the electromagnetic induction in the latter treatments. This case illustrates the variation in technic made necessary by the condition of the patient at each treatment. Determination of dosage requires clinical judgment and it is evident that this is the task of a physician who understands both the patient and the application of electromagnetic induction.

The clinical improvement of the patient was complete and physical findings were all normal for several days before dismissal from the hospital on the 21st day. It is gratifying to obtain such a rapid and complete recovery in a case of postoperative pneumonia.

Summary

1. Electromagnetic induction has benefited all forms of pneumonia described above.

2. The maximum benefit has occurred during the first 48 hours of treatment regardless of the type or stage of the disease, or the severity of symptoms.

3. In all patients treated the relief from dyspnea, cyanosis, and pain was marked; it takes place during and after the first treatment, and is usually quite complete after a second treatment. The fact that these patients are without distress in any position in the prone posture is the best evidence of such relief. In cases which have severe pleuritic pain narcotic requirement is much reduced, e.g. from pantopon gr. ⅓ to codein sulphate, gr. ½; in most cases no narcotic is required.

4. It is significant that all cases treated reached a persistent normal temperature in less than 80 hours after the beginning of treatment.

5. There was no disturbance in the pulse rate as a result of the treatment and improvement occurred coincident with decrease in temperature.

6. In all cases the pathologic processes have cleared up coincident with the crisis, the early incidence of persistent normal temperature supporting this statement.

Conclusions

In the opinion of the author it is possible to obtain good results in the treatment of pneumonia only when adequate dosage is employed in each individual case. This dosage comprises the use of an optimal intensity, prolonged application, and frequent repetition of treatment, factors which must be determined by the exact nature of the pathologic changes and the general condition of the patient. It is important to continue treatment until all pathologic processes have disappeared, even though symptomatically there is apparent recovery and the temperature has remained consistently normal.

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Propose New Way to Protect Against Infantile Paralysis

A chemical method of protecting against infantile paralysis, recommended for trial in the next epidemic of this dread disease, was reported by Drs. A. B. Sabin, P. K. Olitsky and H. R. Cox of the Rockefeller Institute for Medical Research at the meeting of the Society of American Bacteriologists.

The method consists in dropping or spraying into the nose, solutions of either sodium alum or tannic acid in suitable strength. The chemicals seem to act as a shield against the disease by keeping the causative virus from entering the body and reaching the nerve cells in brain and spinal cord.

"Experimentally there is now sufficient basis for a trial in man of these chemicals in the prevention of poliomyelitis during epidemics," the investigators stated.

Tannic acid was first suggested as a suitable chemical for this purpose by Drs. Olitsky and Cox. Sodium alum was advocated as a result of studies by Drs. Charles Armstrong and W. T. Harrison of the National Institute of Health, U. S. Public Health Service.

Most of the studies reported were made with monkeys. However, a number of human volunteers were given nasal treatment with 4 per cent sodium alum solution. They suffered no untoward symptoms other than slight local irritation and nasal discharge for a few hours, indicating that the treatment is safe.

It seems very effective in protecting monkeys against the disease. "Typical poliomyelitis (infantile paralysis) was induced in 26 of 34 untreated monkeys by the instillation on two occasions, 48 hours apart, of 1 cc. of a 10 per cent suspension of poliomyelitic cords into each nostril," it was reported today. "The majority of monkeys treated with either sodium alum or tannic acid for a number of days prior to the instillation of virus were distinctly resistant to poliomyelitis. Only 2 of 20 monkeys treated in that manner with 4 per cent sodium alum developed the disease, and these were in a group which apparently received more than the average amounts of virus. Most of the monkeys treated with 3 per cent alum also proved resistant, while 0.5 per cent and two per cent had no effect. Four per cent tannic acid, although used in a smaller series, was also effective, while 0.4 per cent and 0.8 per cent were not.

"Treatment with alum for at least a few days prior to infection was necessary to induce resistance. The resistance could be maintained over a period of several weeks by one daily instillation of the chemical; omitting the treatment for 48 hours diminished the number of monkeys that were resistant."

The monkeys protected by the chemicals showed neither fever nor any other signs which could be attributed to infantile paralysis. When tested from one to two months later, they had no immunity to the disease, which seems to indicate that none of the virus entered their systems and also that the resistance brought on by the chemicals is not lasting.

The studies also showed that the most effective strengths for both chemicals is in four per cent solutions. — *Science News Letter.*

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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EDITORIALS

IMPRESSIONS OF THE 1936 SESSION OF THE AMERICAN MEDICAL ASSOCIATION

It is with pardonable pride in our membership that we record certain impressions of the 87th annual session of the American Medical Association, held in Kansas City, Missouri. One could not witness the transactions of the House of Delegates very long without becoming impressed with the importance and effectiveness of organized medicine, affecting the weal of every medical practitioner in our country.

To appreciate the significance of what has been said it must be realized that virtually the whole civilized world is in a state of flux, the late effects of an unprecedented war. Without here entering into a detailed consideration of the economic situation affecting the medical profession in Europe, it is sufficient to recall that individually and as a body politic European medicine finds itself helpless in a situation forced upon it by doctrinaire governments. Fortunately for the American medical profession its regimentation and political control by the powers that be is so far only in the air, but nevertheless a threat, the undercurrent of which is already manifest as an attack against the stability and dignity of medical practice. On the principle that an ounce of prevention is better than a pound of cure the authorized representatives of American medicine have just given notice to all concerned that any interference with the free exercise of our vocation will be resisted to the utmost by an organized front. In unmistakable language the House of Delegates of the American Medical Association voiced the sentiment of one hundred thousand physicians that the fantastic economic creeds and theories of certain European political leaders will not be tolerated on American soil. By this firm attitude it would be foolhardy for theorists, whether well intentioned or not, to attempt to foist their pet isms on American physicians. The same holds good for a certain type of political self-

seekers who are looking forward to sinecures in the form of supervisors of communal medical practice. If the House of Delegates had accomplished no more than that, the officers of our national body have earned unstinted praise and profound gratitude from every self-respecting member of our profession.

The need and value of organization both for unhampered scientific advance and the protection of individual rights has been expressed indirectly through the circumstance that the number of physicians who have flocked to Kansas City to participate in the deliberations has exceeded the anticipation of the officials of the Association. Within two days after the opening of the session identification badges had to be improvised. If this is not sufficient proof, one needed but attend a few of the formal and informal gatherings usually arranged at each annual meeting, to obtain evidence of the general interest in the problems we are confronted with at this time.

Materially everything connected with the meeting was propitious for success. In the newly built municipal auditorium, ample space was provided for the scientific and technical exhibits, while an enormous amphitheater was more than adequate to seat all members and visitors for the general sessions. An unusually large number of scientific exhibits creditably reflected the trend of scientific medicine. The reports presented at the diverse specialistic sections were in keeping with the progress chronicled at preceding meetings. To us especially interested in physical medicine, it was gratifying to notice that not a few of the scientific papers and exhibits concerned many problems of physical therapy and electrosurgery. It was natural that the various sections should present discussions relative to the latest progress of physical medicine and surgery. Thus fever therapy, the management of carcinoma, electrotherapy in certain ophthalmic conditions, the diagnostic value of the galvanic current in intracranial tumors, the value of electropyrexia and electrosurgery in the field of urologic practice added to the sum total of our present knowledge. In brief our impressions of the 1936 session of our American Medical Association can be summed up as it having been one of the most memorable in the history of our national body.

QUALIFICATIONS FOR PHYSICAL THERAPY TECHNICIANS

The American College of Surgeons in their report on hospital standardization for 1934 state that "hospitals carrying on physical therapy should have a well organized department with adequate, trained personnel under competent medical supervision." The selection of the trained technician is most important for the Council of Physical Therapy of the American Medical Association states that ninety per cent of the necessary physical therapy in a general hospital can be accomplished by exercises, massage, muscle training and posture work. This requires no equipment but does require the services of a specially trained technician.

The Council of Physical Therapy published in 1930 their opinion on the education of physical therapy technicians. This year the Council on Medical Education of the American Medical Association will finish their inspection of schools for physical therapy technicians and will publish a list of approved schools. Previous to this the American Physiotherapy Association, a national association of physical therapy technicians, published a list of these approved schools. The national organization assumed the task of passing on the qualifications of physical therapy technicians. Their requirements for admission to their society were, graduation from a recognized school of nursing or a school of physical education, and in addition, graduation from a recognized school for physical therapy technicians. This association's secretary, Miss Jefferson Brown, Adelaide Tichenor Clinic, Long Beach, California, will cooperate with hospitals in securing adequately trained physical therapy technicians.

Since physical therapy is a definite part of medicine, it was believed that the training and qualifications of physical therapy technicians should be judged by the medical profession. Therefore the American Congress of Physical Therapy, national organization of

physicians interested in physical therapy, aided by the Council on Medical Education of the American Medical Association, have recently established the "American Registry of Physical Therapy Technicians."

Upon request, the registrar will furnish blanks on which formal applications are made for certification, with data to be filled in giving information as to the applicant's preliminary education, technical education, experience in physical therapy, training and experience in related fields, and references from two licensed physicians.

Eligibility for Certification

In the registry there are two classes.

A. Physical Therapy Technicians.

1. Applicants who were graduated from an approved school of physical therapy. The Board shall accept as approved those schools passed by the Council on Medical Education and Hospitals of the American Medical Association.

2. Individuals who have worked in Physical Therapy for seven years or more in institutions or organizations acceptable to the Board of Registry. Applicants shall have had a high school education and shall be required to pass a written, oral and a practical examination given by the regional board. Registration in this group shall not be permitted after January 1, 1938.

B. Junior Physical Therapy Technicians.

Applicants who have completed high school education and have had four years of experience in physical therapy under the supervision of qualified physicians. These applicants shall be required to pass written, oral and practical examinations of a more limited scope. Registrations in this group shall not be permitted after January 1, 1938.

After January 1, 1938, applicants for junior physical therapy technicians shall be required to have the following qualifications:

1. Graduation from an accredited school of nursing or physical education which meets the requirements set by law in the individual state, and in addition have had, not less than one year of training and experience in physical therapy, under qualified physicians.

2. Completion of 60 university credit hours, including 24 hours of physics, chemistry, zoology, biology, and in addition not less than one year of training and experience in physical therapy under qualified physicians.

In view of the newness of the Registry it is recommended that during 1936 the technician in charge of a physical therapy department should be either a member of the American Physiotherapy Association or a registered physical therapy technician of the American Registry of Physical Therapy Technicians.

After January 1, 1937, it is recommended that all physical therapy technicians in approved hospitals have a certificate from the American Registry of Physical Therapy Technicians. This registry now has a list of registered physical therapy technicians and junior physical therapy technicians. The registrar, Miss Marion Smith, 30 North Michigan Avenue, Chicago, Illinois, will cooperate with hospitals in securing properly qualified technicians.

In adition to adequate physical therapy training the other important factors in the selection of these technicians are personality, moral integrity and a knowledge of hospital ethics and routine. — Hospitals **10**:105 (Feb.) 1936.

WESTERN SECTIONAL MEETING

The Western Section of the Congress will hold its annual spring meeting June 18, in Los Angeles, at the Los Angeles County Medical Building. The committee announces that Dr. William Bierman of New York City will be their guest speaker. The program which appears in full elsewhere in this issue covers a one day session devoted to widely varied subjects all related to physical therapy.

Physicians, medical students, and technicians are urged to plan attendance.

SCIENCE, NEWS, COMMENTS

Pacific Physical Therapy Association Meeting

The regular April meeting of the Pacific Physical Therapy Association was held April 29 at the Hollywood Hospital at which time a Symposium on Skin Diseases was presented as follows: 1. "Electrosurgical Methods in the Treatment of Benign and Malignant Neoplasms of the Skin," Demonstration and Paper by *Samuel Ayres*, Jr., M.D. Los Angeles; 2. "Physiotherapy in the Treatment of Acne," by *Moses Scholtz*, M.D., Los Angeles. The discussion was opened by *Paul D. Foster*, M.D., Los Angeles.

Committee On Physical Therapy Appointed By Tennessee State Medical Association

At the recent meeting in Memphis of the Tennessee State Medical Association, it was announced that a Committee on Physical Therapy had been appointed for the first time. Dr. Alphonse H. Meyer of Memphis was selected as Chairman.

Dr. John S. Coulter Adresses Various Meetings

A paper on "Physical Therapy in Arthritis" was presented by Dr. Coulter at the meeting of the Tennessee State Medical Association, at their recent State meeting in Memphis April 16.

At the annual convention in St. Louis of the American Physical Education Association, Dr. Coulter read a paper on April 17, entitled "Physiological Basis for Physical Therapy."

On May 5, Dr. Coulter conducted a one-day clinic on Physical Therapy for the Decatur and Macon County Medical Society at St. Mary's Hospital, Decatur, Illinois. Dr. Coulter was the guest speaker of the evening meeting of this Society and presented a paper on "Short Wave Diathermy."

American Physiotherapy Association Convention

The 1936 Convention of the American Physiotherapy Association will be held June 29, 30, July 1 and 2, at the Ambassador Hotel, Los Angeles, California. Some of the speakers and their papers are as follows: "Fever Therapy," *Rodney Atsatt*, M.D.; "The Recent Poliomyelitis Epidemic in Los Angeles," *Robert W. Meals*, M.D.; "Body Mechanics," *Sven Lokrantz*, M.D.; "Mental Maturation," *Frederic P. Woellner*, M.D.; "Evolution of Muscular Physiology," *Steele F. Stewart*, M.D.; "Normal and Abnormal Mental Mechanisms," *James Houlooze*, M.D.

Catherine Worthingham, San Jose State College, San Jose, Calif., is Convention Chairman.

International Society Hydrology Meeting

The Annual Meeting of the International Society of Medical Hydrology which is open to non-members on payment of a fee £1, is to be held this year in Austria, from the 10th to the 16th October, 1936. The opening ceremonies and the first medical discussion will take place in Innsbruck, by kind invitation of the University and of the Municipality; the party will then proceed to Badgastein, visiting Hofgastein also, and from there to Salzburg. An optional one-day motor tour of the Salzkammergut follows the meeting, and there will also be optional excursions to Vienna and Budapest, beginning on the 17th.

The two principal subjects for consideration are: "The Spa Treatment of Disorders of Old Age," to be introduced by Sir Humphry Rolleston, followed by Prof. Pap (Budapest) and Dr. J. Schneyer (Badgastein); and "Radio-Activity in Medicinal Waters" studied in its physical, physiological and clinical aspects by Dr. Penkava (Prague), Dr. Gerke (Badgastein) and Drs. Pierret and Stieffel (La Bourboule and Plombières). Supplementary papers may be offered, and there will also be an open session, for communications on any hydrological subject.

A party will be formed to travel from London on the 9th October. The anticipated costs of participation are, if a party of 15 can be formed, £10 to £11 return fare to Innsbruck and back from Salzburg, plus the "inclusive charge of 180 Austrian Schillings (circa £7) for travelling, accommodation, board, etc., after arrival at Innsbruck. Fuller particulars may be obtained from the General Secretary, International Society of Medical Hydrology, 109, Kingsway, London, W.C.2.

For additional information it is suggested that American physicians communicate with Dr. W. S. McClellan, Medical Director of Saratoga Springs, N. Y.

Erratum

The Federal Housing Administration has ceased the insurance of loans as applying to therapeutical equipment and other equipment on April 1st.

The reference to the Federal Housing Administration plan as included in the Conducto-Therm Corporation advertisement in the April issue was included by error.

THE STUDENT'S LIBRARY

KURZWELLENTHERAPIE. Die Medizinische Anwendung Elektrischer Höchstfrequenzen. By Dr. *Erwin Schliephake*, Dozent an der Universität Giessen. With collaboration of Dr. *Gonter* (Diseases of Gums and Teeth), Dr. *D. L. Rohde* (Physical Formulas), Prof. Dr. *C. H. Sattler* (Diseases of the Eye). Third Edition. Paper. Pp. 230 with 153 illustrations. Price RM: 11.50. Jena: Gustav Fischer, 1936.

This work has been favorably reviewed in the ARCHIVES on past occasions. The present new and enlarged edition is essentially a reprint of preceding editions. Two sections have been added, one dealing with affections of the gums and the paradentoses written by Dr. Gonter, a dentist, and another by Dr. Sattler, which deals with the application of short wave therapy in diseases of the eye. Sattler has tried out both the spark gap and tube apparatus in only 54 cases, but has secured information from other sources which he incorporated into a chapter of about three and one-half pages. It appears that he and his informants have secured favorable results in some infections and inflammatory conditions of the eye. In cataract, retrobulbar neuritis, glaucoma the results were either meager or negative. This very brief chapter is not very impressive, Professor Sattler admitting that much work will have to be done before short wave therapy can be definitely established in ophthalmic practice. Dr. Gonter's chapter on dental conditions occupies a little more than one page, the greatest part of which is devoted to a few incomplete case reports and an apology for their presentation. The results in the cases presented are not likely to arouse the interest of the dental profession. It is rather astonishing that the author who has earned his reputation as the foremost exponent of this new therapy should have allowed incomplete observations and meager data provided by these contributors to bring a note of discord into a work otherwise representative of the best on this subject. On the other hand it is noted that this edition maintains the previous high literary standard, and is enhanced by an index that was missing in the older issues. There is no doubt that this work still maintains its leadership in the literary contributions on short wave therapy.

THE HUMAN FOOT. By *Dudley J. Morton*, M.D., Associate Professor of Anatomy, College of Physicians and Surgeons, Columbia University. Cloth. Pp. 244 with 100 illustrations. Price $3.00. New York: Columbia University Press, 1935.

The importance of the general problem of foot disorders is apparent. In examination of male college students, the incidence of these disorders, of a degree capable of producing symptoms or of limiting the individual's normal activity, has been estimated as high as 40 per cent, and it is reasonable to believe the rate is even higher in women. The above listed work is distinctly revolutionary in its concept of foot trouble. The first part is devoted to a consideration of the evolutionary background of the human foot. From these studies the author opposes the emphasis placed on muscle control as the predominating factor in foot balance. His tests of muscle strength failed to show any consistency in differences of strength between pronators and supinators. Dr. Morton also opposes the concept of the existence of an anterior transverse metatarsal arch. He shows that in the distribution of body weight through the feet the head of each metatarsal bone shared equally in the support of body weight with the single exception of the first metatarsal which bore a double share. According to the author, the principal factors in the etiology of foot troubles are shortness of the first metatarsal, posteriorly located sesamoids, hypermobility of the first metatarsal segment and shortness of the calf muscles. The last part of the book gives excellent suggestions in the treatment of the clinical symptoms and disordered functions of the feet. This volume should be in the library of everyone interested in physical therapy.

REPORTS ON CHRONIC RHEUMATIC DISEASES. — ANNUAL REPORT OF THE BRITISH COMMITTEE ON CHRONIC RHEUMATIC DISEASES. NUMBER ONE. Edited by *C. W. Buckley*, M.D., F.R.C.P. Cloth. Pp. 159. Price 12s. 6d. London: H. K. Lewis and Company, Ltd., 1935.

This volume should be of interest to those studying the subject of chronic arthritis, as it gives the results of recent research work, both clinical and laboratory performed in Great Britain. As indicated by the title, the topic under consideration represents the opinions of the British committee on chronic rheumatic diseases, which in a broader sense reflects the experiences encountered in other countries with reference to the same problem. Thus while the point of view incorporated in this report may emanate from a source remote from our shores, their environmental and social conditions are by no means different from those encountered in our own land. The existing similarity of causative factors and symptoms must be recognized, appreciated and eradicated, hence the above published report contains a message that is timely and provocative. That cognizance is taken of some of the new procedures is exemplified by the chapter on "The Place of Histamine in the Treatment of Chronic Rheumatism" a procedure that is now enlisting the interest of the entire profession. The review of the world's literature on this subject at the end of the volume provides a more complete reference than is ordinarily available in publications on chronic rheumatic diseases.

A SYNOPSIS OF PHYSIOLOGY. By *A. Rendle Short,* B.Sc., M.D., F.R.C.S. Professor of Surgery, University of Bristol; late Examiner for the Primary F.R.C.S., and *C. I. Ham,* M.B., B.Ch., F.R.C.S. (Ed.) Late Demonstrator in Physiology to the University of Bristol. Second Edition Edited by *C. L. G. Pratt,* M.Sc., M.D., Lecturer in Physiology, St. Thomas' Hospital Medical School. Cloth. Pp 312. Illustrated with Colored and Other Diagrams. Price, $3.50. Baltimore: William Wood & Company, 1936.

"The object of the book is to give a fairly full summary of modern physiology, particularly human physiology, in a small compass." In other words, this book affords a means of quick perusal of modern physiology. For the student such an outline would be far from adequate, but for the busy practitioner it probably answers a definite need. It is clear that the author appreciates the need of supplementary lectures or textbook information to round out a knowledge of the subject. The second edition was prompted by many changes which have been noted in human and clinical physiology. New chapters have been added; some have been rewritten; and nearly all contain some alterations. "Knowledge has advanced particularly in three branches of the subject: Endocrine glands, vitamins, and the chemical physiology of the reproductive system." The original authors having retired from active teaching of physiology, it became necessary to enlist help, and the changes in this edition are almost entirely the work of Dr. Pratt. This synopsis while valuable for quick reference may prove especially of interest as a guide in teaching the subject of physiology.

FOR STUTTERERS. By *Smiley Blanton,* M.D., Assistant Professor of Clinical Psychiatry, Cornell University Medical College, and *Margaret Gray Blanton.* With an introduction by *J. Ramsay Hunt,* M.D., Sc.D., Professor of Neurology, Columbia University. Cloth. Pp. 191. Price $2.00. New York and London: D. Appleton-Century Co., Inc., 1936.

This book is primarily for stutterers, but there is no one interested in this subject who will not find it a valuable and informative treatise on a rather neglected field. Dr. Blanton is an authority in this division of medical research, and Mrs. Blanton has conducted a special summer school for this disorder. The authors are convinced through their experience that every case of stuttering has its root in some definite emotional cause. Therefore it is not a disease in itself, but a symptom of a deep seated psychological disturbance which must be cured before the speech defect can be eradicated. Their treatment of stuttering is presented under such practical captions as, "What the Parents Can Do;" "What the Teacher Can Do;" "What the Public Can Do;" "What the Stutterer Can Do;" and "Personal Adjustment." The authors have the support of modern psychiatric practice in their interpretation of psychologic speech mechanisms as found in the stuttering patient.

CONVALESCENT CARE IN GREAT BRITAIN. By *Elizabeth Greene Gardiner,* Assistant Professor and Supervisor of Medical Social Work, University of Minnesota. Social Service Monographs Number Thirty-four. Cloth. Pp. 163. Price $1.50. Chicago: The University of Chicago Press, 1935.

There is a growing interest in convalescent care in the United States, but as fifty per cent of all convalescent facilities are concentrated in the vicinity of New York, it is evident that the rest of the country suffers from a heavy shortage of such resources. This volume is a study of the extent of institutional convalescent care in England, Wales and Scotland. The author believes that physical therapy in Great Britain is more highly developed than in the United States. Three of the 36 convalescent homes visited had a very high standard, two establishments were so well equipped with various forms of hydrotherapy that the patients went there for carefully planned treatments, while five others employed a part time physiotherapist. One well organized institution of 150 beds had five physiotherapists. As the problem of convalescent care is closely associated with physical therapy, this book will be found both informative and useful to those interested in this subject.

INTERNATIONAL ABSTRACTS

Diathermy in the Treatment of Primary Pneumonia. J. G. Jenkins.

Texas State J. Med. **31**:494 (Dec.) 1935.

Diathermy is indicated in all forms of pneumonia, except in cases where the patient may have had pulmonary tuberculosis; here the treatment may do more harm than good.

The technic is not difficult but must be exact. Careless methods will not give good results. One should have a high-frequency apparatus that will deliver a smooth, non-faradic current, with a frequency of four million or more, and sufficient voltage to drive the current rapidly through the tissues. Proper plates should be selected and it is necessary that they make close contact with the patient to prevent sparking. The apparatus should always be checked before treatment is started. The symptomatic relief alone justifies its use. Convalescence is shortened. The mortality rate in 103 cases treated by diathermy was 7.76 per cent.

Aseptic Electrosurgical Enterostomy. Lester R. Whitaker.

Am. J. Digest. Dis. & Nutrit. **2**:630 (Dec.) 1935.

The experimental apparatus consisted of a small rectal tube, cut off to a length of ten inches and the tip beveled. Also a wire-loop electrode of the proper size with a handle of sufficient length to be put through the tube. Experiments were made upon the stomach of the dog. A stitch is taken in the wall of the stomach and tied; then the end of the tube is placed just proximal to it, and buried in the wall of the stomach by a continuous mattress or Lembert stitch for a distance of about one to one and one-half inches. The suture is held tightly around the tube to prevent leakage when the opening is made. The wire-loop of the electrode is bent a little to come into contact with the side of the tube. It is then inserted, and when by palpation it is felt to be in contact with the wall of the stomach at the end of the tube, the current is turned on. The "cutting current" with low voltage and heavy dehydration is used. The object is to cut through the wall of the viscus, and at the same time to produce coagulation to stop bleeding from any vessels. The electrode is turned around to be sure to make a circular opening. The anterior wall has to be held up in order to keep the electrode from damaging the opposite wall. With care and avoiding too much pressure on the electrode, this is easily prevented. The free end of the tube is held out laterally over the edge of the wound to avoid contamination from escaping fluid. Then the electrode is withdrawn a little to bring it back just inside the tube. The handle acts as an obturator and gives the necessary stiffness for the tube to be pushed into the opening. This is done while the end of the suture is held taut to prevent leakage. Then the suture is tied in the tissues and the ends tied around the tube to hold it.

Sacro-Iliac Strain. Rodney F. Atsatt.

Physiotherapy Rev. **14**:139 (Sept.-Oct.) 1935.

Any one or more of the following conditions may be present in a sacro-iliac disturbance. Simple strain of the ligaments, perhaps most commonly brought about by a forward rotation of the sacrum on one or both ilia. This causes strain and irritation on the posterior sacro-iliac interosseus and sacro-tuberous ligaments. Spasm of the hamstring muscles is often seen. A considerable proportion of the origin of the long head of the biceps as well as the semitendinosus is from the great sacro-sciatic ligament, and thus any pull on the hamstring muscle is communicated directly to the irritated ligament.

Distinguished from the rotatory motions of the sacro-iliac joint must be considered the actual rotatory dislocations. These often are present in those patients who come in with severe continued pain and who are relieved by manipulation, sometimes with an audible click. Lastly, we must consider arthritis of the joint.

The treatment consists of strapping, bed rest, heel correction, and adjustment of a belt. In the second week thermotherapy and massage are employed. Suitable exercises augment the physical therapy and insure in a few months virtually full recovery.

Examination of Urinary and Biliary Calculi by Ultraviolet Rays. V. Faber.

Ztschr. f. Path. **47**:421 (Nov. 23) 1934.

Faber observed that urinary and biliary calculi show fluorescence in filtered ultraviolet rays. The urinary calculi showed on exposure to ultraviolet rays a greater number of layers and a more manifold coloration than they did in ordinary light. From the color of the fluorescence it may be concluded of what substances the calculus is composed. The fluorescence of urinary calculi is due to the substances that by absorption are combined with the salts, which form the calculi. Since bile pigments interfere with fluorescence, it is impossible to deduce conclusions about the composition of biliary calculi from the nature of their fluorescence. — [Abst. J. A. M. A. **104**:115 (Feb. 9) 1935.]

Electrosurgery in Gynecology. Benedict F. Boland.

Medical Record **142**:375 (Oct. 16) 1935.

Electrocoagulation, electrodesiccation and the cutting current has been applied to inflammatory, benign and malignant growths of the vulva, urethra, cervix and ovaries. The ability of electrosurgical currents to penetrate the affected tissue and devitalize cancer cells and to seal lymphatics and blood vessels removes the probability of metastasis and also preserves much healthy tissue. Excision of precancerous and malignant specimens for biopsy has removed the dangers of reimplantation and dissemination of cancer cells, together with metastasis into other regions following knife dissection. In inflammatory disease like endocervicitis each type of current may be applied. The indications depend upon local conditions, and as no two cervices are alike the problem must be handled individually. The cutting, desiccation and coagulation currents have been recommended by their advocates. Each has its place and it can be definitely stated that neither is a panacea in every case.

Effect of Artificial Fever on Pulse-Volume Changes of Finger.

Am. J. M. Sc. **190**:485 (Oct.) 1935.

Johnson and his associates observed an increased pulse-volume change with all types of artificial fever except foreign protein, which gave a primary decrease of the pulse-volume change associated with the chill. They interpret the increased pulse-volume change as increased circulation, a result of the vasodilatation and probably increased cardiac output. The effect of artificial fever on peripheral circulation, when induced by general heat with prevention of heat loss, was about the same with all the methods used. The finger volume change increased from about 0.01 cc. control to from 0.06 to 0.08 cc. The maximum circulatory response occurred at a temperature considerably lower than the maximum used. The amplitude of the excursions measuring the circulatory response showed marked variations as the temperature was maintained, which they interpreted as due to instability of the vasomotor system and instability of the heat regulating mechanism, which is intimately associated with the vasomotor system. This indicates that there may be an optimal temperature at which a maximal circulatory response occurs. This suggests that high therapeutic fevers up to 106 degrees F. as often used are too high unless factors other than circulation play a part and are brought out only by fevers above the optimum. The circulatory response to artificial fever induced with foreign protein differed from that obtained with artificial fever induced by external heat. Foreign protein uniformly in five patients gave a primary vasoconstriction associated with the chill and followed by a vasodilatation. The vasodilatation was never as great as that produced by the other methods unless heat loss was prevented by insulating the body and the fever maintained. Clinically good results are obtained with foreign protein therapy in spite of the fact that the peripheral circulatory response is not as great as with fever induced by other methods. The fundamental difference in the results of foreign protein fever and that produced by external heat is that the vasoconstriction and vasodilatation of foreign protein fever is probably of central origin, while the vasodilatation with fevers produced by other means is chiefly of peripheral origin. Artificial fever produced by external heat is dangerous unless proper precautions are taken, and even then some patients do not tolerate fever well, particularly those with impairment of the cardiovascular system. Proper equipment is paramount. A recording thermometer should be used so that an accurate observation of the temperature can be had at all times. A physician should be present at all times, and means for emergency treatment of heat exhaustion should be available. The ability to tolerate this type of artificial fever seems to be related to the cardiovascular reserve. The question of how long the fever should be maintained is debatable. The authors feel that it should not be run to the point of exhaustion. Regarding the best method of inducing artificial fever from external heat, they believe that the ordinary electric light cabinet is probably the best. The most dangerous method is probably the hot water bath. — [Abst. J. A. M. A. **105**: 1716 (Nov. 23) 1935.]

Artificial Fever Therapy of Syphilis. Walter M. Simpson.

J. A. M. A. **105**:2132 (Dec. 28) 1935.

In the last four years Simpson has subjected 383 patients to 2,844 artificial fever treatments (approximately 16,000 hours of sustained fever). With the exception of occasional mild skin burns, which occurred particularly at the beginning of this undertaking, no person has been injured by the treatments. Of these, 175 patients have been treated for syphilis. Forty-three patients failed to co-operate, either during treatment or in the progress studies; the records of these patients are incomplete and are not included in this analysis. Forty-two patients have been under observation less than six months; these are also excluded from consideration. Sixteen patients with early syphilis have been treated with either fever therapy alone or chemotherapy alone, as control groups. One hundred and six syphilitic patients have been under observation for from six months to three and one-half years; these provide the data for this report.

The following conclusions of the author is based on the combination of form of bismuth arsphenamine sulfonate (Bismarsen), with fever treatments:

1. The value of artificially induced fever therapy as an adjunct to chemotherapy in the management of neurosyphilis is now firmly established. The one factor common to the wide variety of infectious, chemical and physical meth-

ods that have yielded comparable therapeutic results in simple fever production.

2. A simplified, controlled and relatively inexpensive method for fever induction and maintenance (Kettering hypertherm) has been devised. High frequency electric currents are not employed. During the past four years, 383 patients have been subjected to 2,844 artificial fever treatments, without any serious ill effects related to the method of treatment.

3. The frequent observation that the best results occurred when neurosyphilis was treated by combined fever and chemotherapy during its earliest manifestations led us to apply the treatment to patients with primary or early secondary syphilis. The results provide evidence that fever therapy may be of great value in early syphilis, particularly when chemotherapy alone appears to be inadequate.

4. The results obtained in the treatment of symptomatic neurosyphilis, asymptomatic neurosyphilis and resistant seropositive syphilis are at least comparable to the results obtained with the more hazardous, time consuming and inconstant malaria therapy.

5. Hospitalization is not a requirement for fever therapy by physical means.

6. The advent of simple and safe methods for the production of artificial fever should stimulate vigorous investigations of the possibility that the time, effort and expense involved in the adequate antisyphilitic therapy may be greatly lessened.

Infections and Treatment of the Cervix Uteri. W. C. Payne.

J. Florida M. A., **22**:299 (Jan.) 1936.

The area cauterized should always be allowed enfirely to heal before another cauterization is done. This usually requires about four weeks, or longer. After the cervix has been exposed, if there are any cysts present, each of them is punctured with the cautery tip and only one lip of the cervix is cauterized at one treatment. In this way, there is no danger that the entire circumference of the cervical canal may be cauterized at one time, thus minimizing the chances of a stricture. The cold cautery tip is introduced up to the internal os and is held against either the posterior or anterior wall of the canal. The current is then turned on and the tip gradually brought out over the infected area of the cervix. The entire surface of the lip of the cervix which is being treated is cauterized and no attempt is made to leave any viable mucous membrane on that wall of the cervical canal. One month later the other lip of the cervix is treated similarly. This procedure is repeated, alternating the anterior and posterior lips until all evidence of infection has subsided. Electrocauterization is contraindicated in acute and subacute infections of the cervix and uterine adnexa. It is also contraindicated in the latter weeks of pregnancy. Some authorities consider it contraindicated in any stage of pregnancy.

Fever Therapy in Gonorrheal Arthritis and Chorea. T. G. Schnabel, and F. Fetter.

Am. Int. Med. **9**:398 (Oct.) 1935.

Schnabel and Fetter induced fever by circulating humidified hot air in the Kettering hypertherm in treating 9 acute and 9 chronic cases of gonorrheal arthritis and 12 cases of Sydenham's chorea. Of the 9 patients with acute gonorrheal arthritis, five were cured, three markedly improved and one moderately improved. Nine patients with chorea were cured and two were markedly improved. One died as a result of a disturbance of his heat regulating mechanism. No patient having either of these diseases failed to respond favorably to this form of treatment. It is believed that fever therapy offers the best chance of cure for both gonorrheal arthritis and chorea. — [Abst. J. A. M. A. **105**:2017 (Dec. 14) 1935.]

Ultrashort Wave Therapy in Tuberculosis. O. Schedtler.

Beitr. z. klin. d.Tuberk. **86**:189 (April 25) 1935.

In preliminary experiments with ultrashort waves Schedtler gave the impression that the heat effect seems to be the chief factor in ultrashort wave therapy. He therefore resorted to it in tuberculous processes in which heat, hyperemization and anti-inflammatory measures were indicated. He treated fourteen patients, in whom pulmonary tuberculosis was complicated by dry pleurisy, with ultrashort waves of from 3.5 to 6 meters and obtained favorable results. Six cases of wet pleurisy, most of them of tuberculous etiology, were likewise treated with ultrashort waves. This treatment never produced prompt cessation of the exudation, but four refractory cases were led to resorption and adhesion, while in the two other cases the treatment remained ineffective. Three cases of tuberculous plural empyema were not influenced by the treatment, while two patients who had nontuberculous pleural suppurations recovered. In fistulating glandular processes and in tuberculosis of the joints and bones, ultrashort wave therapy was given in addition to open air rest cure and to cod liver oil treatment. None of these cases showed a noticeable improvement as the result of the ultrashort wave therapy, which, however, proved highly effective in three cases of nonspecific chronic multiple arthritis. In four cases of tuberculous peritonitis, the ultrashort waves produced considerable improvement. The symptoms of intestinal tuberculosis likewise were favorably influenced. In view of the fact that patients with pulmonary tuberculosis are highly sensitive to all types of rays, the author was cautious in the application of ultrashort waves to these patients, and his observations justified this attitude. Convincing therapeutic effects were not produced. Summarizing, the author points out that ultrashort wave therapy seems to be justified within certain limitations. He was unable to demonstrate specific actions and thinks that this new form of ray therapy can be employed whenever

intensive heating is desirable. This applies particularly to the various forms of pleurisy. The analgesic action of the ultrashort rays should be given further attention. In the author's observations on the effect of ultrashort waves in tuberculous processes of the larynx and of the eyes, thus far, he gained the impression that they promote the healing process, provided the general condition is good and the treatment is continued for a sufficient length of time. — [Abst. J. A. M. A. **105**:84 (July) 1935.]

An Improved Source of Ultraviolet Light for the Diagnosis of Ringworm of the Scalp. A. M. Davidson; S. A. Boyd, and C. P. Haltalin.

Canad. M. A. J. **33**:534 (Nov.) 1935.

Undoubtedly the best source of the so-called "Wood's light" used for this purpose is a water-cooled quartz mercury-arc lamp, fitted with a Wood's glass or some other filter which transmits the longer ultraviolet waves and absorbs most of the visible light. The expense and difficulty of transportation of such a lamp makes it impractical for general use. In 1932 Davidson and Gregory produced an inexpensive portable lamp which could be plugged into any lighting circuit. For practical purposes this lamp served equally well as a quartz lamp, but it was realized that a more suitable design could be made and, as a result, an improved portable lamp which is inexpensive, smaller, lighter, and more effective has been produced. The lamp is small, being only 2 inches in diameter and 3 inches long, with an overall length of 5 inches, including an insulated handle. Its weight, including the switch and cord, is only 10 ounces. The small transformer, which is not handled during the examination, measures 2 by 7 by 2½ inches, and the entire apparatus can be carried in a small case, 5 by 7 by 2 inches, or packed in the doctor's everyday bag.

Irradiation in Trigeminus Neuralgia. Richard Ausch.

Med. Klin. **30**:513 (April 13) 1934.

In a case of refractory trigeminus neuralgia Ausch resorted to treatment with the cold quartz lamp. In sixteen sessions the rays were applied from the outside at the infraorbital foramen, as well as intraorally along the entire right maxilla. The final result was complete freedom from pain, which has persisted for more than a year. The author employed this method in more than twenty cases, and on the basis of his observations he concludes that the cold quartz lamp should always be tried before resorting to alcohol injection or to a surgical intervention in trigeminus neuralgia. Since July, 1933, the author's method has been adopted by a clinic, and favorable results have been corroborated. He admits that ultraviolet irradiations in cases of trigeminus neuralgia are not new as such. The new aspect of his method is that the cold quartz lamp makes it possible to approach the second and third branches of the trigeminus from the oral side. The burner of the cold quartz lamp can be brought into direct contact with the mucous membrane. — [Abst. J. A. M. A. **102**:2072 (June 16) 1934.]

Metabolic Rates in Therapeutic Fever. I. Kopp.

Am. J. Med. Sci. **190**:491 (Oct.) 1935.

Kopp determined the metabolic rates of seven patients having neurosyphilis, in whom fever was induced by artificial means. In six patients in whom fever was induced by the combined method of diathermy current, electric blanket and hot moist air, determinations were started about two and one-half hours after a light breakfast. In the seventh patient, in whom fever was induced by diathermy current, electric cabinet and hot, moist air, a method combining the diathermy current, the electric blanket and hot, moist air, electric blanket and mixed typhoid vaccine, all determinations were made under basal conditions. An increase in the metabolic rate occurred when fever was induced by the combined method of diathermy current, electric light blanket and hot, moist air. Though a rather suggestive linear relationship was present, fluctuations of a fairly marked degree occurred at different temperature levels when the group is taken as a whole. This may be due to individual variations in the degree of discomfort manifesting itself especially by hyperpnea, the metabolic rates at higher levels paralleling, as a rule, the amount of hyperpnea present. Repeated metabolic rates obtained on one patient under basal conditions in a series of experiments during which body temperature was raised by similar methods and obtained at different levels from one to three hours revealed a fairly uniform increase in body metabolism for each degree of temperature rise. The removal of the insulating hot, moist air blanket when the body temperature had reached its desired height was followed in nearly all cases by a rather steep fall in metabolic rate, whether body temperature remained at the same level, fell or even rose. Metabolic rates for similar temperature levels were higher when the temperature was rising. The diathermy current alone over short intervals had no specific effect on the basal metabolic rate, provided no rise in body temperature occurred. Increases in metabolic rate obtained on the one patient, in whom a rise of temperature was induced by the five different methods, showed a rather striking parallelism and did not differ much from the accepted rise of 7.2 per cent for each degree Fahrenheit, except in fever induced by diathermy current alone. In the latter the average rise in metabolic rate was 2.4 per cent and 3.9 per cent for each degree of fever. The rapidity of the rise in body temperature played no part in the results obtained. Repeated fever treatment of one patient over a period of seven months had no residual effect on the basal metabolic rate. — [Abst. J. A. M. A. **105**:1716 (Nov. 23) 1935.]

DEVELOPMENT OF SHORT WAVE THERAPY *

ERWIN SCHLIEPHAKE, M.D.
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Part I

Short wave therapy has made rapid strides since its incipiency. This demonstrates how much there has been lacking in the objectivity and effectiveness of electrotherapy. On the other hand the speedy development contains great dangers not only for the method as such but also for the patients. The danger for the method lies in the possibility of it becoming discredited. Every electrotherapeutic factory believes it necessary to place a short wave apparatus in the market, and every physician believes to be behind the times unless he possesses such an apparatus. Traveling salesmen recommend apparatus, the actual efficiency of which the purchaser cannot judge, which, however, afford the patient a pleasant sense of warmth. All imaginable diseases and affections are then uncritically subject to treatment.

It is clear that such a growth must necessarily give rise to a counter effect, created by partly justified and fruitful criticism. Sometimes, however, this criticism exceeds the proper goal, leading to a destructive condemnation based on utter lack of knowledge of the method and of its fundamentals. Failures in certain domains lead to the conclusion that the entire method is useless, while some characteristics in common with diathermy have been responsible for the opinion that the method is merely a modified diathermy. When burns take place as a consequence of inadequate technical knowledge and limited familiarity with the literature, the blame is not put on the therapist but the method, as is the case when by improper dosage a disease is not cured or even made worse. Finally there are critics who reject the method if it does not produce at least 100 per cent of success. The reply to this is, that there is no such a thing as a therapeutic method with 100 per cent success. Thus, to illustrate, the surgical treatment of appendicitis does not lead to a cure in all cases, but though it involves a bloody procedure we refer most patients with appendicitis to the surgeon. No one will think of condemning the art of surgery because there are poor surgeons, dull instruments and improper asepsis! A method can be judged only by its results at the hands of a truly experienced therapist.

In judging short wave therapy we must not leave out of sight that unlike surgery it is not a closed discipline, but is still in the first stage of development. The method and its indications have been but partly built up. Let us not overlook how much time it has taken until roentgenotherapy has become a somewhat useful procedure. By contrast short wave therapy has been in existence but a few years. Though experiments on the biologic effects of short electric waves have been made earlier, one can speak of the discovery of short wave therapy only as from the moment when the exact and incontrovertible proof of its effect on human disease was first established. To this must be added the proof that the short wave procedure actually is something different from similar procedures that had been in vogue, as, for example, diathermy. These differences have been described detailedly in my book *Kurzwellentherapie*, and in this article only a few points will be discussed to a limited extent.

* *Note:*—This is the first of a series of three articles by Dr. Schliephake, the next will appear in the July number. — EDITOR.

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Initial Experiments

Short wave biology, although in a certain sense a similar process, did not originate in diathermy, but has developed independently. Lakhovsky was a pioneer on this path, because he endeavored to effect plants with a short wave sender of special construction. As precursors of the present method, one must consider the experiments by Stieböck, who worked with frequencies corresponding to a 40 m wave, though they yielded no applicable results. The condenser field was first employed in animal experiments by Schereschewsky, Esau and myself. These experiments were first carried out on mice and later on larger animals, and made possible the knowledge of the biologic effects of the ultrashort waves and created the preliminary conditions for their utilization in the therapy of man. As these resulted in the death of the experimental animals it seemed daring to employ the short wave field for human ailments, for one had to figure on injuring health. Only after having treated a furuncle on my own body did we have an opportunity to test the healing effect of the short wave field, and from then on one could venture to use short wave therapy on patients and to develop its indications. In this personal experiment we had to deal with a furuncle of the nose, which after treatment healed within 48 hours. In that way we established the proof of an effect different from that of diathermy, for, as is known, diathermy is strictly contraindicated in acute suppurations, as it leads to a spreading of the processes.

The effect of the short wave field which was first shown by Schereschewsky and that of the condenser field on experimental animals by myself, is — heat. This heating was studied later by Richard and Loomis, Baldwin and Nelson and other investigators. On the bases of these investigations it had to be assumed that the death of the animals took place in the condenser field. For me there arose the question whether this heat was identical with that of diathermy or possessed especial characteristics. It was striking at the very beginning that the heating of the animals took place in closed glass vessels without the least contact with the electrodes. This is impossible with diathermy currents. Accordingly I undertook experiments with diverse human and animal tissues, and I observed that these tissues are heated at different degrees in one and the same field. The heating did not depend on the relation of conduction resistance, as is the case with diathermy, but had an entirely different aspect. As this peculiar reaction was ascribable only to the electrolytic or colloidal components of the tissues, I investigated, because of the simplicity of the conditions, the behavior of electrolytes in the short wave field.

It was seen that with various dilutions of an electrolyte, e. g. NaCl, a maximum of heat was attained with a definite concentration. We found the maximum with a 3 m wave in a 0.2 per cent solution. Stronger and weaker dilutions became heated to a lesser degree. I had already seen in my experiments with tissues that the relations varied with different wavelengths. At that time came the experiments by Pätzold, who has studied the heating of electrolytes of various dilutions with diverse wavelengths. His findings were confirmed in the contemporaneous publications of McLennan and Burton.

The results of these investigations are: If the electrolyte has the conduction capacity K and the dielectric constant ϵ, the maximum heating appears when the following condition is fulfilled: Frequency $\nu = \frac{2K}{\epsilon}$.

The heating maximum under otherwise equal conditions therefore depends on conduction capacity and dielectric constant of the solution on one, and the wavelength on the other side. This characteristic attains value for therapeutic application only through the strong capacitive effect on the short wave field. On

its part it is a function of frequency, the "capacity of penetration" becoming greater with increasing frequency.

If we send an electric current of low frequency through an object, the current becomes distributed through the object as current. The density of the current is very great under the electrodes, and small in the middle of the object. (It is presupposed that the object is larger than the surface of the electrodes, as is the case in therapy). As the heating depends on the square of the current density, it is less in the middle of the object than under the electrodes. This behavior is especially pronounced when one does not deal with a homogenous object but with different layers, such as the human body. Let us imagine that a human arm is passed longitudinally by an electric current. The current lines come close together where they encounter the least resistance and where they meet with fewer interruptions of the current path, that is along the blood channels and the long muscles. If we construct a phantom of three layers through which a current is passed longitudinally, it will be seen that it is always the least conducting layer that contains most of the flow, while the other layers are scarcely in the path of the current. In the accompanying illustration (fig. 1.*A*) the conducting capacity of the first layer is given as 1, that of the second layer as 2 and that of the third layer as 3. The layers will become heated in the order of their conducting capacity. If on the other hand we conduct the current across the object (fig. 1.*B*) we will observe an entirely different behavior. Here the current cannot branch out in the three layers and must pass all three at equal intensity. As a result the heating in 1 is greatest and least in 3. In the illustration the intensity of heating per time unit is shown by the height of the columns.

If we expose our phantom to an ultrashort wave field we will see that while there are certain differences between longitudinal and transverse passages of the current, these are manifested within relatively small limits. Within certain limits the three materials behave according to the above given equation, irrespective whether the condenser field is applied longitudinally or transversely. This has been demonstrated also by Breitwieser.

This becomes possible through the capacitive bridging of layers of poor conductivity. It is manifested by the circumstances that the condenser field has an effect on the object without direct contact, and that interposed air or other insulating layers affect the action not at all or very little. The degree with which such layers are spanned depends on the make-up of the layers and the employed wavelength. The capacitive action is the greater, the smaller the conducting capacity of the layers, that is the better they insulate. It becomes stronger in a given substance with increasing frequency. Accordingly the condenser field does not act like a conducted current which passes all layers one after the other or alongside, but the field effect attacks immediately the individual particles located within the field. The individual layers become heated, as was already mentioned, according to the dielectric constant of the substance and the wavelength, and this independent of their relative position.

There are two deviations from this rule, one of which I have discovered empirically. The depth effect of the condenser field takes place only at a sufficiently large distance of the electrodes from the surface of the object. The effect provided by a change of the distance can be demonstrated in a simple manner. If electrodes are applied closely to a vessel containing water there soon appears strong heating of the water at the edges under the electrodes, and one notes after some time the development of steam bubbles. If the electrodes are moved away a few centimeters one attains a uniform heating of the entire liquid contents also in depth. The capacitive action therefore becomes sufficiently effective only through interposed air capacity. We cannot here undertake a theoretic explanation of this phenomenon, but it rests in part on breaking of the lines of force and in part on the homogenization of the tension in the field.

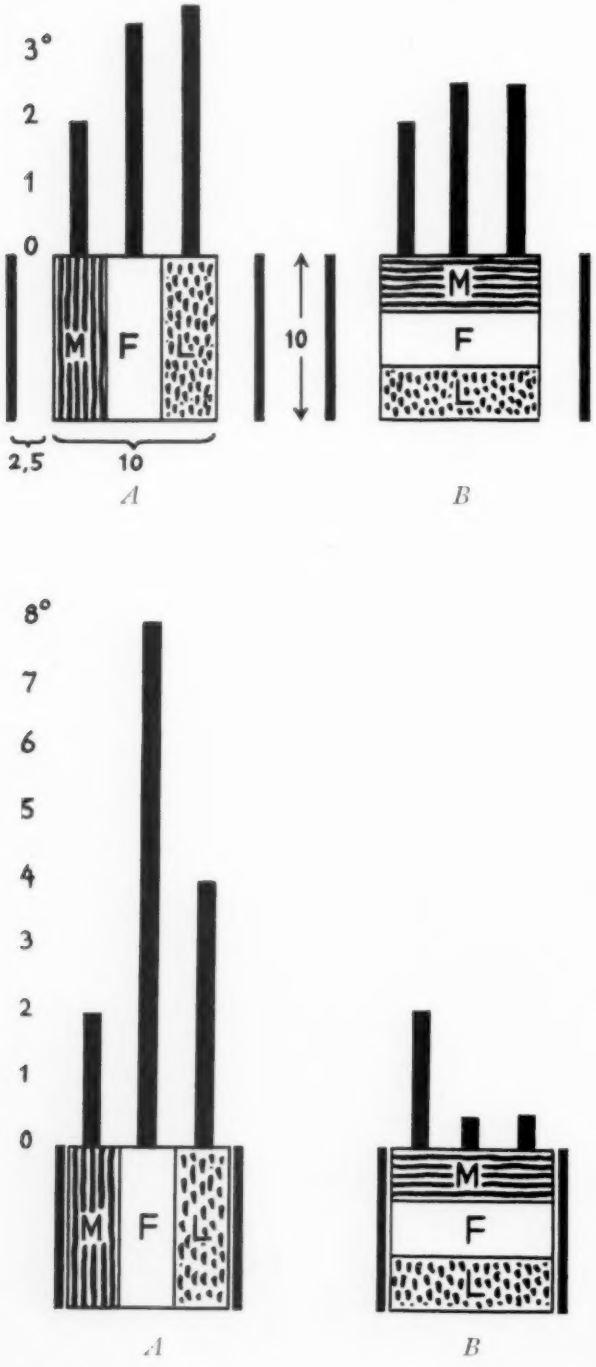

Fig. 1.—*A* and *B*. — Influence of the distance of electrodes from the phantom. Three layers (muscle, fat, lung) are radiated longitudinally and transversely. At an adequate distance of the plates the effect is rather homogenous and the direction of the layers plays an insignificant rôle. At a short distance, the differences become pronounced similarly as with conventional diathermy. (All numbers are reduced in a manner so that the value of muscle is always 2.)

All interposed dielectrics disturb this effect. The substance which according to my experience produces the least disturbance is quartz, and next in order glass. For this reason I have provided the electrodes with glass cups, which are arranged so that the interposed layer of air can be changed in its width. This is essential as one needs a different electrode-air separation according to the thickness of the bodily part to be treated. According to my experience, which is confirmed by Kowarschik, all other interposed substances produce a lessened depth effect. For example, use has been made of electrodes covered by rubber and fastened to the bodily part, of felt layers, or treatment has been given through clothes. Experiments on depth effects in the condenser field carried out with interposed materials of these kinds are absolutely valueless. With the glass cups, too, it matters what kind of glass is utilized as some makes (e. g. glass containing lead or metals) on heating lead the current and therefore act only like a second condenser plate applied directly to the skin. Experiments on dead material are therefore unobjectionable only when carried out with great air distances and without interposition of any other kind of substance.

Depth Effect and Burns

Pätzold and Gebbert have experimentally shown that the relative depth dosage of the short waves is a function of the electrode distance from the surface of the object. By relative depth dosage we understand the relation of the heating in the middle between the electrodes, that is in the depth of the tissues, to that of the surface. This relative depth dosage is small in diathermy currents on account of the disappearingly small capacitive components, as Bessemans and Vanhoutheghem and others have recently demonstrated on the living animal body. With short waves they can become fairly large, provided the electrodes are properly employed, as I have demonstrated by different experiments on living human beings, and was recently shown by Pratt and Sheard in animal experiments. Just the same most often heating of the bodily surface is somewhat higher than in depth. This causes no harm, as the sense of warmth in the skin is one of the most important factors by which to measure dosage and to prevent overheating (fig. 2.).

Fig. 2. — Air spaced glass electrodes.

In the course of six years and in more than 50,000 treatments I have seen burns with the manner of application just described only twice. They were insignificant and healed spontaneously within a few days. With some attention they can be avoided with almost absolute certainty, provided one masters the technic of short wave therapy. With rubber electrodes, burns may occur because the rubber gradually undergoes structural change from the effect of the short wave field. It becomes increased in conductivity at some places, where the current jumps to the skin, which may result in burns. Similar changes may take place when the electrode cables are insulated by rubber. When these cables

lie anywhere on the body, there, too, the current may cross to the body. This can happen only because of inadequate familiarity with the physical fundamentals of short wave therapy. Whoever is familiar with them knows that the cables must be adequately separated from any objects in the vicinity, as otherwise the oscillatory courses in the circuit are disturbed. These objects often act as additional capacities and change the distribution of the current and tension in the oscillating circuit and in the field.

Another possibility for burns exists especially in electropyrexia, which involves an increase of temperature of the whole body by means of the short wave field. If beads of perspiration appear at the bodily surface, the lines of force are broken at the surface of these drops, creating an intensification of heat. An attempt has been made to remove the drops by blowing hot air, but this is not even necessary if the patient has been wrapped in woolen blankets for the purpose of absorbing the perspiration. With some attention this kind of burns, too, can be avoided. If accumulation of moisture appears under the glass electrodes, an interposed piece of filter paper suffices to cause its removal and to render it harmless.

The depth effect of the short waves in layered media affords us the possibility of attaining selective effects on certain tissues. Selective heating, which is based on the variable conductive capacity of the individual layers, can be demonstrated on phantoms above described. If we take different wavelengths, the heating relation of the individual layers to each other is changed. One would assume that the strongest heating at diverse wavelengths will occur in that layer whose condition corresponds to the above given formula. But here we have an exception which was discovered by Schaefer.

Let us assume that the middle of several layers is to be heated the most. In such a case the attainment of the maximum depends also on the consistency of the outer layers. If their conductive capacity is better than that of the middle layer a larger wavelength is necessary than one might anticipate by the calculation. If on the other hand the conductive capacity of the external layer is small, that is, its resistance is very high, then we attain the maximum heating of the middle layer by as high a frequency as possible, and therefore shorter wavelength. This behavior is especially important for therapy, for the skin and the layer of fat present a higher resistance than the deeper tissues and we therefore need a short wave to attain a maximal depth effect.

Selective Heating

Apart from these exceptions the selective heating of electrically differentiated layers and also smallest particles has been proved experimentally. I will present at this time two experiments, one by Koehler and another by myself. Two diffusion tubes of different diameter are arranged one in the other and placed in a glass containing distilled water. The middle tube contains 0.2 per cent salt solution, while the farther tube contains fat. On applying to the phantom a diathermy current there appears a distribution of heat in accord with Ohm's law. The water with its high specific resistance becomes intensely heated, the fat but poorly so, for the current flows around it, and the contents of the innermost tube become heated very little or not at all. If we now place this phantom in a condenser field, the heat distribution is entirely different. By selection of a definite wavelength we can achieve the greatest heating of the liquid in the middle, and a lesser heating of the fat and surrounding water. With the short wave field we have therefore the means under certain circumstances to create heat from within to the exterior.

Esau was the first to demonstrate by a few experiments that smallest particles are influenced immediately by the condenser field. He mixed a small quan-

tity of an electrolytic solution (best potash lye) with paraffin oil and exposed this emulsion to the condenser field. After a short time this mixture develops considerable steam and comes to a boil. Measurement of the temperature shows that it amounts to only 50 — 70 degrees C., depending on the mixture and the employed wavelength. Accordingly the finely distributed water droplets have attained a temperature of 100 degrees C. while the paraffin remained cold. The water becomes ebullient out of the cold paraffin. Carbon or graphite powder placed in a field becomes heated to the glowing point, as was shown by Esau in 1929 (fig. 3.).

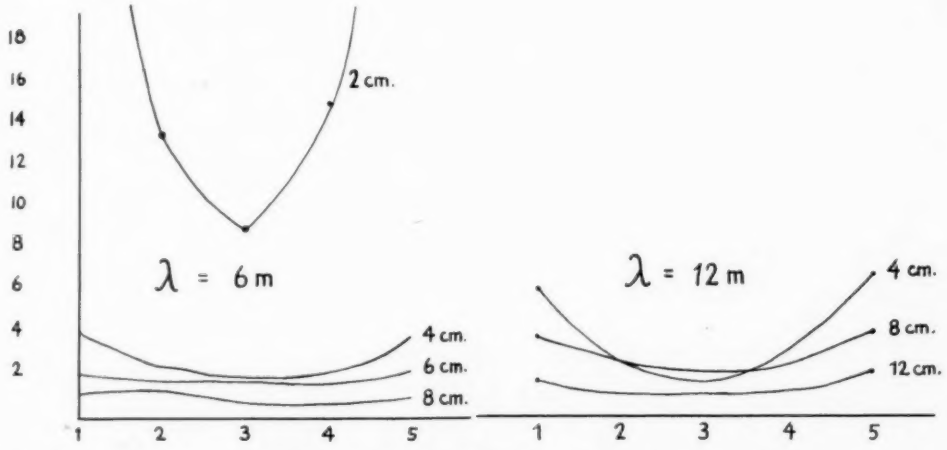

Fig. 3. — Depth effect in a phantom composed of glass tubes with liquids at different distances of the electrodes from the surface.

Even when carbon powder is placed in a liquid it becomes intensely heated, and I established that the size of the particles plays the decisive rôle. I made use of carbon powders of variably sized particles but otherwise of identical composition. The individual powders in equal quantities were placed in a definite quantity of gelatin and exposed to the condenser field. In these experiments the diverse samples become heated at different intensities, the most intense being seen in the one containing the largest particles.

I demonstrated a peculiar phenomenon with animal charcoal placed in water. If a small quantity of ether is added to such an emulsion, it becomes absorbed at the coal. If such a mixture is placed in a strong condenser field, one observes minute sparks appearing in the liquid. I take it that the adsorbed ether forms an insulating layer around the coal particles, between which there are created tensions resulting in sparking across the layer of ether. This experiment shows how strong tensions may be developed in the interior of such suspensions.

One may offer the objection that we are dealing with experiments on dead material, which have no application to living tissues. For this reason the selective effects have been demonstrated in human and animal components of tissues, and first of all on blood. If we expose a quantity of blood to a condenser field, the blood becomes heated in one minute to a definite degree. If we now separate the red blood corpuscles from the serum by centrifuge, we note that the serum alone becomes heated much less and the mass of erythrocytes more than the whole blood. If we place erythrocytes into the serum or into an isotonic NaCl solution, the heating becomes the greater the larger the quantity of the added erythrocytes. From this it is evident that the heating of the erythrocytes within the liquid is greater than that of the environment. Schaefer has investigated the absorption of short wave energy in blood by determinations of the

angle of loss, and has found that with a definite wavelength in the interior of the erythrocytes the energy is absorbed seven times more than in the same parts of volume of the surrounding serum. With the diathermy current on the other hand it was always the serum which became heated most intensely. Similar tests by McLennan have yielded identical results.

How is this behavior of the erythrocytes to be explained? Each erythrocyte contains a definite amount of an electrolyte which, we may safely assume, is surrounded by an insulating lipoid envelope. If we cause a diathermy current to flow through a suspension of the erythrocytes the envelope acts as an insulator. The path of the current is narrowed by the erythrocytes through which the suspension acquires a higher resistance to conduction and becomes heated more than the serum.

By increasing the frequency, the lipoid envelope is capacitively spanned in the domain of the short wave frequencies. We may visualize this envelope as the dielectric of a condenser, the plates of which are formed by the contents and the surrounding liquid. There appears a conduction current in the interior of the blood corpuscle, the blood corpuscles participating in the process of conduction. This current at first becomes stronger as the frequency is increased until a maximum is reached, which is not exceeded.

Schaefer and Daenzer furthermore have shown that similar effects may appear not only with erythrocytes but also with colloidal particles, and thus we arrive at the assumption of a point heating in colloidally dispersed substances in the condenser field. The specific effects of the condenser field rest in part on the circumstance that according to the wavelength electric energy is transformed into heat at definite points of the substance. This is in accord with my view, which I expressed years ago, that the special effects of the short waves can attack only the colloids. The electric charges of the colloid particles may sustain displacements through the forces of the condenser field. As the colloid characteristic, especially hydration of hydrophile colloids depend to a great extent on the strength and distribution of the charges, changes of these peculiarities may be produced. These manifest themselves as changes of the electric peculiarities, especially the capacity of conduction for high frequencies and the dielectric constant. (We cannot enter here into details of the problems associated with the relaxation and dipole theory of Debye.) I. Hausser, as an example has shown in this way that certain colloidal molecules, above all the sphyngomyelin present in the brain, sustain changes with wavelengths between 3 and 8 meters.

Collaborating with Ostertag and Strassburger I obtained experimentally selective changes in animal cells. By treatment of the brain and the medulla oblongata of rabbits peculiar disturbances of the regulation of temperature were produced (For details refer to my book). Histologic examinations made by Ostertag showed selective changes of definite kinds of ganglionic cells of the dorsal vagal nucleus, while other cells close by of a somewhat different kind remained unharmed. This type of damage could be produced only with wavelengths below 3.50 meters, those over 4 meters not once having produced these changes in many experiments.

Here we may add the experiments Reiter made with inoculation sarcoma of rats which manifested an especially strong effect from wavelengths of 3.40 meters. Of interest are also the experiments by Keller and Schlaf with animal organs and tissues. If, for example, muscular meat of freshly killed animals is let alone, there appears in the course of time an acidity which runs as a definite curve. By measurement of the hydrogen ion concentration it was shown that after a passage of a short wave current the acidity curve runs differently, the acidity appearing later (fig. 4.). The heating does not appear to play a rôle in this, for when the same temperature rise was attained by other means there

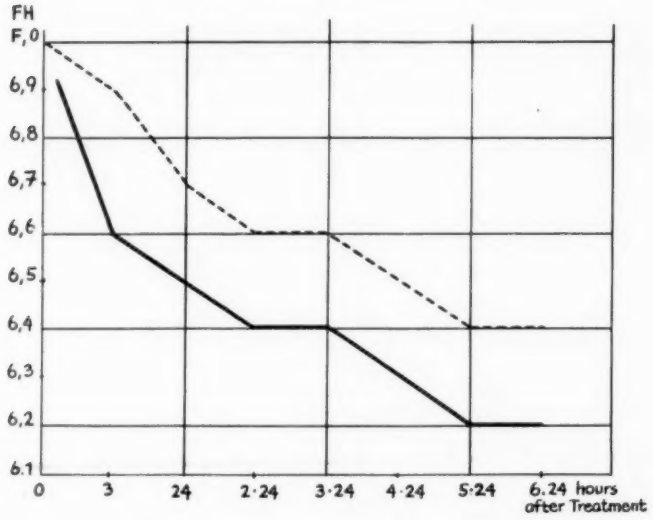

Fig. 4. — Change of pH in the lung tissue with and without short wave radiation. Simple heating produces no change. The broken line indicates untreated, and the unbroken that treated for 12 minutes.

appeared no differences. On the other hand the change of the acidity curve was the greater, the shorter the utilized wavelength employed, even though it produced a lesser degree of heating.

To what extent these experimental findings will prove of importance to practice cannot as yet be determined. At any rate it would be fallacious to endeavor to draw any immediate conclusions from them for the conditions of the living human or animal body. However, we see from them that it does not appear to be solely a matter of general heating, but that other factors must be sought that play a direct rôle in the effect on colloids. Considering the great importance of the colloidal structure for the course of vital processes, it is possible that extensive changes may be attained in certain bodily functions.

Thorough research of all these processes is however essential, as an optimally effective therapy can be built only on such a basis. It is necessary for theory and practice to work hand in hand.

PHYSICAL PROPERTIES OF BONE *

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IOWA CITY

Since treatment in general is based upon the response of living tissue to all forms of irritative agencies, the effectiveness of physical therapy in particular must depend upon the physical properties of the tissues. A physical attack upon living structure will result in either tissue stimulation or in damage, depending on the degree of the same maneuver. That range embraces the whole register of tissue reaction from stimulation to destruction, and in each case the response in the last analysis rests upon the physical resistance of the structure.

It would seem, then, that the analysis of physical properties is of paramount interest; but in the history of physical therapy there is little to show that the fundamental significance of such investigations was appreciated. In fact, although physical therapy in one form or other has been practiced for thousands of years, scientific investigation into the physical properties of human tissues is crowded into the short space of the last two or three generations.

This presentation is an attempt to present the mechanical properties of one of the structures involved in human locomotion, namely, the skeleton. It has been the subject of scientific studies longer and more intensively than the other structures which make up the locomotor apparatus. There may be two reasons for this: In the first place, it is more subject to change by trauma or disease than other structures; and, secondly, as the stable element of the locomotor apparatus, its physical analysis is easier and more exact.

The data must be divided in those pertaining to bone tissue in general, and in those which arise from the specific structural arrangement and relation in diverse anatomic situations. In other words, there are, first, the general qualities of bone as a special type of differentiated tissue; and second, the specific mechanic properties which vary with the anatomic situation and with the different mechanical demands made by gravity and other physical forces.

General Data

From the general mechanical point of view we are interested in bone as mass and as structure. As a mass, information is desirable as to its relation to volume; in other words, what is the specific gravity of this particular structure? As a structure, we should know the resistance it offers against external forces; in other words, what is the strength of the material and what elasticity does it offer against deformation?

Specific Gravity. — As early as 1865 (Krause and Fischer) the specific gravity of bone was investigated. One method is that of the hydrostatic scales in which the bone is weighed in air and then in water, the loss of weight in water against the loss of weight in air being the specific weight of the body. Another is the so-called picnometer method (Hülsen). If P is the weight of picnometer filled with distilled water, m the weight of the solid body, and P_1 the weight of the picnometer plus distilled water plus solid body

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 9, 1935.

submerged in it, then the specific gravity $S = \frac{m}{P + m - P_1}$.

The specific weight of fresh compact bone in the animal is, according to these investigations, between 1.50 and 2.02, with an average of 1.87; for the adult man, from 1.81 to 1.90; and for the average new born baby, 1.65. In later examinations Rauber found the specific weight of the compacta to be from 1.9 to 2.1; and of the spongy substance from 1.2 to 1.5 of specific gravity.

The density of bone depends upon the age and the muscle activity of the individual; the younger the individual and the less muscle activity, the smaller its density, and vice versa. The mineral substances amount to 55, the organic substances to 26.8, and water to 17.9 per cent. The specific weight of bone tissue grows in proportion to the increase of percentage in mineral substance, and it also increases in proportion as the organic substances decrease. Burnt out bone has a specific gravity of 2.95, whereas that of decalcified bone, that is of osteoid bone, is only 1.74, with the water content up to 65 per cent. When we consider that the skeletal system amounts to about one-seventh of the total weight of the body, an increase of its specific gravity of 50 per cent in sclerotic bone or a decrease of the specific gravity of almost the same percentage in high degree of osteoporosis must make a considerable difference.

Furthermore, the ratio between organic and inorganic constituents is different for the same bone; the thigh bone of the adult may have 62.2 mineral parts and 37.5 per cent of water and organic material, with a specific weight of 2.00; the same bone in the new born baby shows 35.4 of mineral parts and 64.6 per cent of organic parts and water, with a specific weight of 1.6. With the increase of specific weight by a certain percentage, the percentual increase of the mineral parts may be two or three times greater. The fluctuations for pathologic bone are infinitely larger and increase of the organic and water constituents at the expense of the mineral constituents in porotic or atrophic bone may reach extreme proportions. These data are significant because both the elasticity and the breaking strength of bone depend to no small degree upon the chemical constitution.

Elasticity and Strength of Material. — Elasticity is an internal force of a body brought forth under the influence of external stress, and is measured by the elasticity module, i. e., the ratio of the force applied to the deformation produced.

Deformations are due to tension or compression, to shear or torsion, and for each of these there is a certain module of elasticity, that is, a certain ratio of the applying force to the deformation. The human bone is very incompletely elastic, that is to say, it will assume its shape after a deforming force has ceased to apply only to a certain point, after which point the tissue will yield. It is of importance to establish first the point at which the elasticity ceases and deformation becomes permanent, and, second, the point where failure or break of the tissue results.

In bone it is particularly the breaking point which is of medical interest. In other tissue, for instance the ligaments, we are interested not only in the breaking point but also in the point of elasticity limit, i. e., the one where deformation persists and the ligament remains elongated or relaxed. Chronic ligamentous strains cover a great field in clinical pathology, and for that reason the studies of Gratz and others on elasticity of fascial tissue are very timely contributions.

Given the coefficient of elasticity and the breaking strength of normal bone within its physiologic limits, it should be possible in a given case to

determine whether or not a certain force is likely to produce a fracture. If not, one must necessarily deduce that the stress resistance of the fractured bone is pathologically diminished. One appreciates at once the wide application of such facts in legal and insurance medicine.

Hard bodies, such as bone with a very high elasticity coefficient, show very small deformations under ordinary stress, and they do not, when the load ceases to exist, assume their primary shape promptly — a phenomenon which is known as "after-reaction."

The strength of the material equals that force which is just able to cause a breaking of the body upon which it acts. The relation between this force and the dimensions of the body, the cross section area, has been established.

For the different structures of the body the strength of material has been studied for many decades. Wintingham, Hales and Burner, as early as 1777, determined the resistance of blood vessels against tension. Wertheim, in 1853, was one of the earlier investigators of the resistance of bone against tension or pressure, using dry bone specimens of uniform dimensions, taken from the compacta of the femur and the fibula. He found that for bone the elongations are reasonably proportional to the stress, that is, they behave like inorganic bodies. This is particularly true when the bones are well dried out, and is different for muscle and other soft tissues of the human body which contain a great percentage of moisture.

In the latter, the ratio of force to deformity, plotted as coordinates, appears not as a straight line, as for inorganic material, but as a curve, approximating a hyperbola with the vertex in the origin of the coordinate system. The equation of this curve is $Y^2 = a\,x^2 + b\,x$ and from it it is possible to determine the constants a and b in any particular experiment, b representing moisture.

The difference between the elastic behavior of the soft parts of the human body and that of the solid parts arises mainly from the moisture which is contained in the former; physically speaking, the constant b (see equation, $Y^2 = a\,x^2 + b\,x$) decreases proportionately to the drying out of the specimen. Therefore, a dry tendon behaves very much like fresh bone when the constant b becomes zero and Y becomes proportionate to x, that means the load is proportionate to the deformation, or the material again acquires the elasticity property of all other solid material. Here is the mathematical proof for the old theory that moisture alone causes the difference between the mechanical properties of organic and inorganic materials.

Physical Data on Absolute Strength of Material

The absolute tensile and bending strength of fresh, normal warm human compacta at middle age is between 9.45 and 12.41 kg/mm^2. The compression strength against pressure forces varies 12.58 and 16.8 kg/mm^2 (Rauber, 1876). So we see that the compression strength of the bone is greater than the bending strength, being about twice that of wood or lead; it increases on drying and decreases on heating. With age, on the other hand, the tensile strength of bone decreases more than the compression strength.

Spongious bone has a much smaller index for compression. For instance, in the femoral neck the spongiosa has a compression resistance of only 0.96 kg/mm^2. To illustrate the strength of bone, I quote the following values given by Messerer: The clavicle has a bending strength of 192, the shaft of the femur 766 kg., average.

There seems to be a great difference between these values of the strength of bone and the actual forces under which in practical life fractures occur.

In reality, the breaks take place under the influence of much smaller weights. The reason for this is that in the experiments the strength resistance is measured under so-called static conditions, that is, where the tissues as well as the load are resting. In reality, however, the breaking of the bone occurs more often under dynamic stress, that is, under the influence of masses which have certain velocities.

A man is buried in a mine under a ton or more of slate and his femur or his spine breaks; or he is pinned by his car against the wall and his chest is crushed. This is a so-called "static condition" of failure because the breaking load appears at rest or nearly so; and this is also the more exceptional mechanism of fracture. A man falling a height from a scaffold fractures his os calcis; or, struck by an automobile, has his tibia broken; or, a speeding bullet shatters his femur; these are examples of dynamic situations in which the masses producing fracture are smaller but are moving with great speed. This is the common mechanogenesis of fractures. In reality, the greater mass of the so-called static load moves as well as the smaller dynamic one, because fracture is mechanical work and work always means force (or weight) multiplied by distance. The resting slate must bend the femur until it breaks. But its moving distance is so small and its velocity therefore so slow that we are not aware of the movement of the mass.

On the other hand, to realize the effect of rapidly moving masses one must consider the living energy which they produce in moving. This energy, or living force, equalling one-half of the products of the mass multiplied by the square of the velocity, $\left(\frac{M v^2}{2}\right)$, gives the impact, and, naturally, a smaller mass (bullet) moving rapidly may produce the same impact as a much greater mass moving slowly. Instead of speaking of the breaking load in kg. or lbs., one should therefore rather determine the work in ft. lbs. or kgm., accomplished in producing such a fracture.

In order to establish this, it is not only necessary to know the impact force but also the amount of deformity which had been produced by this force before it came to the fracture; the work done is then equal to the product of the force multiplied by the deformation. In our own experiments the values are, accordingly, given in kgm. or foot, or inch lbs.

The Breaking Point. — The following instance illustrates this point: The elasticity coefficient of bone is 2,000 kg/mm², which means that, theoretically, a rod made of compact bone would, to double its length, require a force of 2,000 kg/mm². The breaking force of a rod, on the other hand, is at 10 kg/mm². Therefore, the elongation of a rod, 1 mm. in length, stressed to the collapsing point, would be 1/200 mm.; if the rod is 1 mm. long, the elongation up to the collapsing point would be $\frac{1}{200\,\text{mm.}}$. A rod of 100 mm. length and 1 mm.² area would therefore require $\frac{1}{2}\ 100 \cdot \frac{1}{200} \cdot 10 = \frac{1000}{400}$ kgmm. = 0.0025 kgm. of work to produce a break, provided always that there obtains arithmetical progression in relation between length tension and length, as is presupposed by Hooke's law.

Rauber's table gives the comparative strength between bones in moist, fresh state at body temperature, at low temperature, or dry specimens at low temperature.

The Compressive Strength. — 1. Static Load. Pressure resistance of the bone is greater on the whole in compact bone than the tension resistance. It is calculated to be about 20.59 kg/mm.^{2} in axial direction and 15.39 kg/mm.^{2} in transverse direction, according to Hülsen.

Whole vertebrae: Maximum forces in kg.: Fourth dorsal, 240 to 275; sixth dorsal, 360 to 600 kg.; first lumbar, 240 to 1,000; fifth lumbar, 425 to 740. This is a tremendous fluctuation, depending upon age and sex.

The resistance of the pelvis in antero-posterior direction is 200 and 300 kg. In the transverse direction the breaking point of the os ilei varies between 155 and 220 kg. (Messerer.)

2. Dynamic Load. The Skull. According to Schanz, if the skull rests on a plaque with the chin and mastoid, the fracturing force produces an energy of 7.6 Kg., but when the same skull rests upon a model of a spine made of wood and cork, it needs a force of 17.6 Kg. to produce a fracture.

Bending Stress. — The limit value of bending failure on rods of bone of 18 mm. length and 2 to 3.5 mm. thickness has been found in the femur to be a load of 2.1 kg., equal to work between 0.015 and 0.022 kgm. per rod. (Rauber.)

C. O. Weber found on macerated specimens that on fresh material the bending resistance is greater, corresponding to the greater elasticity or the smaller elasticity module. The work under which failure occurs in bending has been found by Messerer to be for the humerus between 1.6 and 2.4 kgm.

The Shear. — The shear and bending stresses cannot be separated since it is impossible to secure shearing stresses entirely free from bending and compression. The shearing stress depends upon the size of the force and upon the cross section of the body to which the force is applied, while the bending stress also depends upon the size of the force and upon the cross section area, and, in addition, upon the distance between these forces. The degree of the shear component of any force depends upon its angle with the cross section area. If it is perpendicular to it, there is no shearing stress since the forces develop no horizontal components; in this case it is a pure pressure force. If it is parallel to it, it is a pure shearing force, and forces applying at an oblique angle, develop components accordingly, corresponding to perpendicular or pressure and parallel or shearing forces. It can be seen that at an inclination of 45 degrees the compression stress will equal the shearing stress.

According to investigations of Rauber, the shearing strength of the compacta, where a load is applied perpendicularly to the fiber, is 11.85 kg/mm^2, while if axial to the fiber the strength is 5.83 kg/mm.^{2} In other words, the shearing is best resisted if applied perpendicularly to the long axis of the bone, or in perpendicular direction of the trajectories.

This is a point of interest which will be discussed later in the consideration of the architecture of bone.

The Torsion Resistance of Bone. — There are innumerable instances where the effect of torsion can be demonstrated on the human skeleton, for instance, forward twist of the upper end of the femur, outward twist of the lower end of the tibia, torsion of the vertebrae. Torsion is produced by two couples of forces acting parallel to each other but in opposite direction. Under anatomic conditions torsion is hardly conceivable without accompanying bending or shearing stress, because the torsion axes and the geometric axes of the bone do not coincide.

The angle obtained by torsion of the femur of a 29-year-old male, with a lever arm of 1600 mm., was at the breaking point, 13.60. The dy-

namic value of the whole work of the torsion effect, when the break occurred, was 2.930 kg. (torsion work experiments).

Form and Architecture

Having discussed the general stress resistances of bones, pressure, tension, shear and torsion stresses, we must next consider the bone as a mechanical unit, suitably constructed to receive stresses of all kind. What is needed, in other words, is an interpretation of both the form and the inner construction of bone capable of receiving and sustaining pressure stresses.

Form. — A better understanding of the weight-bearing ability of the long bone is arrived at, if we adopt for their form, structures of geometric construction. For long, weight bearing pipe bones, we apply the so-called column theory. Since the length of long bones greatly exceeds their diameter, and since they receive gravital as well as muscle stresses along their longitudinal axis, they may be considered as columns eccentrically loaded by a superincumbent weight. That means that, in addition to the vertical strain, there is also active, a transverse force and this latter causes a tensile stress at the convexity and a compression force at the concavity of the bone. The combined compression and tension stresses will summate algebraically. On the side of tension the total pressure becomes decreased, and on the side of compression the total pressure becomes increased, and so the combined compression and tension stresses aggregate to zero in what is called the neutral axis of the bone.

Following up the comparison of the weight-bearing bones with eccentrically loaded columns, the following five situations are represented.

1. Both ends are free to turn about a horizontal axis; this applies to the femur in the sagittal plane, hinged both at the hip and knee joints. (According to the column theory, the bone should assume the shape of a cosine curve, the length of the curve equalling the total length of the bone. The side view shows that this is, in fact, the case.) In this instance, the deflection is at a maximum at the middle of the curve and smallest at both ends where the column intersects with the line of gravity.

2. One end fixed and the other free to turn and move laterally. This is represented by the spine anchored into the pelvis. The effect is a one-half curve with maximum deflection at the top. Here, the deflection is zero at the base, while it is maximal at the top.

3. Both ends are fixed and anchored. An example of this is the tibia in the frontal plane, anchored both at the knee and the ankle. Here, the column forms a full middle and one-half curves at each end. In this case the maximum deviation occurs at the transition points of the curve.

4. One end of the column is fixed, the other turning about one or more horizontal axes, but not laterally. This is the situation in the femur, viewed in the frontal plane. The result is one and one-half cosine curves, or $L = 1\frac{1}{2}\ l$.

5. The column is fixed at the lower end and free to hinge at the upper end and to move laterally. This situation, likewise, may apply to the femur if we consider lateral movement possible with the mass of the body. Here, also, the bend is one and one-half cosine curves, or $L = 1\frac{1}{2}\ l$.

Thus we see that both femur and tibia in the indicated planes correspond in their curves exactly to mechanical expectations for columns weighted and hinged in similar manner.

Another parallel to the geometric construction is offered in the formation of weight-bearing arches, for instance, the arch of the pelvis. The weight-bearing anterior portion of the pelvic ring resembles in the frontal plane a curved beam, weighted in the middle by the spine and trunk, and

supported at the end by the femoral head. The sacrum appears as a keystone of the vault, the pillars of which are formed by the os ilei. The weight stress proceeds obliquely from the center of gravity in the midline to the acetabulum, where it is received by counter stresses through the head of the femur; in the latter the reaction produces pressure upward and inward. According to the configuration of the femoral neck and the inclination of the pelvis, these stresses may become greater or smaller.

A further instance of mechanical construction is the arch of the foot, consisting of a medial or inner and a lateral or outer portion. As the superincumbent body weight reaches the foot, the tibia and the body of the astragalus, the latter becomes the mechanical center of the system. From here the pressure stresses are transmitted forward and backward to the anterior and posterior pillars. At the point of contact with the floor counter stresses are created at the ball of the foot and at the heel, and here, also, the inner architecture is such as to satisfy to perfection the static-dynamic demands made upon that structure.

Architecture of the Bone. — The architecture of the inner structure of the bone is subject to a universal biologic law, generally known as the law of functional adaptation. Much of the functional significance of texture and form of the tissues is evident at first glance; for instance, the thickness of a ligament, the arrangement of its fibers signify certain amounts and directions of mechanic stresses. But there are other anatomic details of form and structure which require closer study.

On the whole, the skeleton plays a more passive rôle in the scheme of locomotion and lends itself better to mechanical analysis. It is not surprising, therefore, that investigators in looking for a relationship between form and function had their attention directed early to the inner structure of bone.

Bourgery already speaks of pressure lines and places some significance to the direction of the trajectories or systems of bone lamellae. In 1838, Ward observed a similarity of the upper end of the human femur with a crane, describing a group of the trabeculae resisting the pressure and another resisting the tension.

The American anatomist, Wyman (1849), likewise, studied the architecture of the spongy substance in the upper end of the femur, of the astragalus and of the os calcaneum, distinguishing in the former a median system, a lateral system, and a third system of small transverse trabeculae conecting the first two.

Engel, in his work on the laws of bone development (1851), sees in the architecture of the several bones an application of the mechanical principle of the ogive and elliptical arch, and points out to the vertical or oblique crossing of trabeculae. Thus the ground was well prepared for the scientific, anatomic, mathematical interpretation of bone structure, which is universally known as Wolff's law of functional adaptation of bone. At a meeting of natural scientists in Zürich, sections of the upper part of the femur were shown by H. v. Meyer in the presence of the mathematician Culman, who at once believed to recognize that the trabecular arrangement coincided precisely with the mathematical calculation of the inner construction lines of a crane.

It was J. Wolff who, after 1867, carried out systematic studies of the inner construction of bones, adding his interpretation of the significance of the trajectory systems which served the distribution of tension and pressure stresses. In the upper end of the femur he distinguished a trabecular system arising from the inner or adductor side; another coming from the trochanteric side, both crossing at right angles in the head and neck; a third from the adductor side into the region of the greater trochanter; a fourth

in the upper end of the shaft splitting up from the compacta on both sides, and, likewise, crossing at right angles.

After Wolff, Roux examined the trajectories in sections of ankylosed knees and came to the analogous conclusion that these lines correspond exactly to the direction of greatest tension and pressure stresses, emphasizing that function in bone, as in all tissues, leads to hypertrophy or enlargement, and lack of mechanical function to atrophy.

Similar anatomic studies of structures have been made subsequently on most of the bones of the skeleton. For instance, the architecture of the vertebrae is described by Japiot and Gallois (1925), who distinguished three distinct trabecular systems.

Some years ago, I examined the trabecular arrangement of the bones of the foot. There is a system from the astragalus running backward into the os calcis, and another running forward from the astragalus to the metatarsals and toes. Both cross at right angles in the body of the astragalus, which is the mechanical center of the system. There are also cross systems resisting tension, such as in the posterior process of the os calcis.

One of the reasons why Wolff and Roux's interpretation aroused so much interest and comment was because it was in apparent contradiction with the older theory of Volkmann and Hueter. The latter found that pressure produces atrophy and loss of bone substance, while Wolff and Roux believed that pressure stresses lead to bone formation. This apparent discrepancy is to be explained by the fact that the older investigators, experimenting with growing bone, produced arrest of growth by pressure upon the epiphyseal cartilage. Obviously, for these rapidly growing and more vulnerable structures the amount of pressure used was of destructive rather than stimulating intensity. There is little doubt that weight-bearing pressure within physiologic limits of degree and duration is a growth stimulating factor.

Wolff lays great stress on rectangular crossing of the trabecular system; the orthogonality, as he calls it. Such orthogonality is, in fact, essential if the trabecular systems are to be interpreted both at pressure and tension resistances. Those who have later questioned the right angle crossing of the trajectory systems, such as Jansen and others, are forced to conclude that pressure alone produces bone atrophy; but there is no reason to doubt that both pressure and tension forces have, according to the degree, a growth stimulating and a growth suppressing phase.

All the apparent deficiencies of Wolff's law seem to be due to the claim that mechanical factors absolutely dominate bone growth, and to the fact that all other biologic factors are disregarded. It is clear that concessions must be made to the behavior of the growing bone, especially to the ossification process proper, which is very sensitive to mechanical influences as well as to other biologic and constitutional factors. But with all these inaccuracies, the law of bone transformation as a whole still stands, because of all factors influencing bone growth, developmental, biochemical, endocrine and mechanical, the latter is the most potent in determining its form and architecture. Therefore, it is permissible, at least for the normal adult bone and with some reservations also for the growing bone, to reason deductively from the form and architecture to mechanical external forces. Under these reservations the law of functional adaptation of bone means that pressure up to a certain limit is the most potent, though not the only, factor to stimulate bone growth, and that its effect can be analyzed and expressed in mathematical terms from the study of the trajectory systems.

Mathematical Calculations of Stresses. — Under the provisions of this law the way is open for the calculation of stresses in many anatomic situations. If one considers the femur as a crane, as Culman did, it is obvious that the

greatest pressure and tension stress would be operative at the lowest level. Wolff calculated that under a weight load of 20 kg. the pressure stress amounts to 163.3 kg. at the lower end and to 8 kg. at the top of the bone.

But if the femur is more correctly considered as an eccentrically loaded column, curved at the upper end and weighted down by a load of 30 kg., the pressure component at the upper levels from the head to the intertrochanteric fossa is 21.5 kg. and the shearing component 22.5 kg.; in the shaft the pressure is 30 kg., the shear 6.5 kg.; at the lower end the pressure is 30 kg., the shear 9.5 kg.

The bending stress is only 1.4 kg/cm.^{2} at the head of the femur, reaches its maximum of 74.6 kg/cm.^{2} at the subtrochanteric region, and drops to 27.2 kg/cm.^{2} at the lower end. Likewise, the tensile stress is zero at the head, has its maximum of 63.4 kg/cm.^{2} below the lesser trochanter, and again drops to 4.8 kg/cm.^{2} at the lower level. This computation also shows the maximum tension as well as compression stresses to lie at the transition of the neck into the diaphysis, and the maximum bending moment is, likewise, in the subtrochanteric region. On the other hand, the maximum shear is at the upper portion of the femoral neck. Therefore, fractures of the head and neck are largely shear fractures; fractures of the trochanteric regions, largely bending fractures.

Pathomechanics

Physical Properties of Bone Under Pathologic Conditions. — When the values of the physical properties of bone vary widely under physiologic conditions, the fluctuations are infinitely larger under all kinds of pathologic conditions. It is, therefore, useless to look for averages for the principal intrinsic physical qualities of bone, such as we use under normal circumstances. Abnormality of reactions, therefore, can only be judged by comparison, when the abnormality is due to changes in the intrinsic resistance of bone.

A. External Force. — External forces produce mechanical changes in the configuration and texture of bone, either because they are abnormally increased, as in static disalignment or in fractures, or abnormally decreased, as in paralysis, elimination of weight bearing and the like.

B. Intrinsic Resistance. — Here, again, the normal values for the physical qualities, namely, density, elasticity, are either increased or decreased.

The effect of increased weight pressure can be seen in the condensation of the internal condyle of the tibia in cases of genu varum, or of the trabecular systems of the scaphoid with formation of exostoses, seen in the flat foot. The effect of diminished pressure is apparent in paralytic limbs or in other conditions where weight bearing had been eliminated for other reasons.

In coxa valga of the paralytic limb, for instance, it is obvious that the stretching of the femoral angle and the changes in the inner architecture can only come about by a trabecular rearrangement through interstitial or endosteal growth adaptation. It is for this reason that Julius Wolff claimed for interstitial bone growth such a dominant rôle. While we know now that enchondral and periosteal bone growth play an important part, the endosteal bone growth is by far the greatest factor in functional bone transformation.

Changes of the physical properties of bone which are due to pathologic alterations are most striking. Specific gravity is increased in different types of osteosclerosis, in syphilis, or in Paget's disease. On the whole, the elasticity of sclerotic bone is decreased rather than increased, and pathologic fractures in condensed bone are not uncommon. On the other hand, there are numerous instances in which the density of bone is decreased, as in osteomalacia and osteoporosis. If there is a decrease of the inorganic con-

tent the elasticity is likewise decreased; but, while in osteoporosis the elasticity and the breaking point are close together, in osteomalacia the bone assumes the properties of plastic bodies and breaks occur less easily. The ease with which the osteoporotic bone breaks when the elasticity limit is overstepped, can readily be seen in the fractures of the spine which occur in older individuals with osteoporosis upon the slightest occasion.

A further instance of bone reaction to loss of elasticity is seen in osteoarthritis of the spine. Here, spur and bridge formations must be explained as a natural response of the bone to offset the loss of the so-called distribution mechanism of the spine. With the degeneration of the intervertebral discs, which are the main carriers of the distribution, the elasticity of the spine is impaired and the spinal column must be fortified by new apposition of bone. In the osteoporotic spine where there is, likewise, a degeneration of the intervertebral discs with loss of the stress distribution mechanism, but where the spine is not fortified by ligamentous ossification and bone bridges, fractures occur very easily.

As one should expect, the microscope fully substantiates the pathologic changes of physical properties of bone.

Of particular interest is the pressure atrophy due to constant and pulsating pressure, as seen in aneurysm. The decreased elasticity in bone can be seen in the bending and curling of lamellae, together with fractures and splitting, as observed in all types of osteomalacic bone, where there is a large amount of soft osteoid tissue.

It is further demonstrated in the osteoporotic spine in the frequent changes in the configuration of the highly elastic intervertebral disc, by the fissures in the substance of the bone and the herniation of disc material into the bone. Marginal plates of bone which are subject to constant pressure show a condensation of the bone lamellae and cancellous bone is transformed into compact bone, as in the shaft.

There is hardly any need for further proof that pathologic reaction of bone to external stresses are the result of changed physical properties.

It may be argued that all these theoretic studies on the physical properties of bone do not yield sufficient practical application to warrant the effort of the analysis, particularly since the pathologic conditions vary so widely in their physical aspects that no norm or constant can be set up. I am not here to argue or judge between the rights of the empiricist and that of the exact scientist. But, there is one point which cannot be emphasized too strongly: That in the traumatology of the locomotor apparatus most of the events happen so close to the borderline between physiologic and ultraphysiologic mechanical events, that the distinction between normal and pathologic reactions becomes very difficult. Both in physical education and in occupational hygiene the question which is forever turning up is: "Is the stress too great or is the resistance too low?" Not all traumatic events are as dramatic as a major railroad injury. Let me remind you only of the innumerable infractions, strains and tears which occur under conditions sometimes in no way different from normal surroundings, particularly in the occupational field. I believe it is of the greatest importance for traumatology that the physical properties of human tissue are known, largely because of the value such knowledge has for the understanding of borderline cases.

TONSILLEXTIRPY

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There is, perhaps, no part of the human body which has less reason for its existence than the tonsil. There is no portion of the human body, on the other hand, so definitely and surely a possible portal of entry for disease. It is because of this important but rather negative function that the medical literature has become so huge on this one subject. It offers a direct avenue for the entrance of infection because of its very structure, its location, and lack of an adequate cleansing secretion.

The tonsil is made up of lymphoid tissue. Its comparatively large surface is further enormously increased[1] by its numerous and branching rootlike crypts which dip into the substance,[2] and can neither cleanse themselves nor be cleansed by any antiseptic. Furthermore, these numerous crypts interlace with similar countlessly branching blood and lymph vessels which enter the tonsil substance from the throat. Infection breaks down the crypt walls[3] and contacts blood vessels connecting with the large vessels that flow almost directly into the heart. Lymph vessels, too, communicate almost directly with large venous trunks. Muscles which firmly enclose the tonsil on three sides compress it and probably enhance the possibility of infection entering the blood stream. Infection of the tonsil crypts therefore is not readily extruded, cannot be suctioned out artificially, cannot be destroyed through antisepsis, and is very rapidly absorbed or disseminated into deeper, important structures. Thus far the consensus of medical opinion has been that persistently infected tonsils, especially after a certain age, should be removed.

Fundamentals of Tonsillectomy

Until recently removal of tonsils consisted solely of lateral incision of the throat, deep enough to involve a layer of retrotonsillar tissue which would readily strip or tear or dissect up with the tonsil itself. Tonsil tissue alone cannot be excised without this retrotonsillar layer. The term enucleation as applied to tonsillectomy is a misnomer, since enucleation implies leaving the shell and removing only the kernel (nucleus). Naturally the layer of tissue removed will vary in thickness and content not only with regard to the extent of chronic infection but according to the judgment of the surgeon.

The tissue removed with the tonsil for want of a better name is called the tonsillar capsule. The raw bleeding surface exposed is quite extensive and becomes infected both from the already infected throat and from extension of the tonsillar infection expressed from its crypts by grasping instruments and by manipulation. Infection of the moist surface results in scarring with a tendency to contraction.[4] An infected cut of the skin will result in a contracting scar, while an abrasion or first degree burn which scabs over without infection results in scarless healing in a relatively short time.

Large opened venous plexuses may result in bleeding which, if unchecked, may lead to shock and death or sepsis by further extension of the infection into the blood stream. Crushing by snare of arteries at the base of the tonsil may produce only temporary occlusion; hemorrhage as late as the sixth or seventh day may ensue. Portions of extruded crypt infection

may be inhaled into deep portions of the lung and cause lung abscess and, perhaps, pneumonia.

The operation itself, in years gone by, has been taken lightly by the majority of physicians and, therefore, by the laity. To the experienced surgeon it is a serious procedure not only because of difficulties which may present themselves but also because of the possibility of an unsatisfactory result. Rarely, the patient may be merely indisposed for a day or two; more frequently, he may be unable to pursue his vocation for a week; too often, a patient has cause to remember a surgical tonsillectomy as one of the ordeals of life. On the part of the physician it may entail simply an examination of the patient, an anesthetic and the operation, with a visit to the patient's room immediately afterward and then again before the patient leaves the hospital — with perhaps an examination some weeks later. Sometimes, however, it may mean one of the most disagreeable experiences in a professional man's life. If, as very frequently happens following the average surgical tonsillectomy, excision is incomplete, [5-6-7] the physician may be perfectly willing to reoperate, but reoperation will seldom remove a deep disappointment on the part of the patient, who may reject such service to seek aid elsewhere.

Cost is frequently a deciding factor as to the amount of care exercised in performing any service. The improper rating of surgical tonsillectomy as a minor operation cheapens it in the eyes of the laity.

Remnants, more or less, even in the presence of joint or heart manifestations are too often considered an incident; to the careful examiner they are sufficient indication for a general anesthetic and a careful dissection.

Despite the above truisms, entirely obvious to the otolaryngologist, only one other method has ever been seriously considered to supersede tonsillectomy. The severest adverse criticism has come from those who admit an inability to remove all tonsillar tissue. Every specialist, however, in advocating the new method in the removal of tonsillar remnants and tags, has admitted a fact which cannot be refuted — that despite all difficulties, successful removal of tonsillar tissue by electrocoagulation leaves more of the throat in a normal condition than is attainable by any other method. It is really tonsillextirpy.

Advantages of Electrocoagulation

The advantages of electrocoagulation are:

1. Only tonsillar tissue is removed.

2. The so-called capsule remains undisturbed, the tissue beneath nontraumatized, the pillars elastic and soft and undiminished in size, even after many years.

3. The coagulated tissue acts as a scab, the best covering yet devised. Beneath it healing occurs without infection and therefore without scarring.

4. No venous plexuses are opened for bleeding or dissemination of infection.

5. Any liquefaction or separation is practically sterile or contains only saprophytic bacteria, and is not complete until the tenth day.

6. There is no loss of time from work or of a single meal.

7. Fifteen minutes are consumed at each sitting — a total of three and one-half hours or less and that as office procedures. The patient, at each sitting, is fully recovered from the previous treatment.

8. The patient returns willingly for examination at any future time and any remnant may be discovered and cared for without special effort.

9. The method is considered by the patient a refined method. It is suitable where the throat should receive the best of attention as in singers,

asthenics or neurotics. If it is suitable in the dangerous, difficult cases, it is doubly safe in the simple ones.

10. There need be left no remnants under patient, persistent effort. The best results of a successful electrocoagulation are theoretically and practically unattainable by any other surgical procedure.

In reviewing recent articles on the subject of electrocoagulation of tonsils one is impressed with the gradual elimination of a number of objections to the method which previously had seemed insurmountable. Today the one outstanding difficulty is exactly the one which is especially evident followed surgical tonsillectomy — the danger of portions of tonsil remaining in the upper and lower angles of the tonsillar fasso. The objections raised in the order of their frequency are: Incomplete removal, frequency of sittings, bleeding, pain — immediate and operative, swelling.

Incomplete removal of tonsils by electrocoagulation is surely not due to inadequacy of the agent because the diathermy current is a powerful agent capable of removing any amount of tissue. It is adjustable to any desired strength, so that the coagulating effect is under absolute control.

The wide applicability of the coagulating current with success is adequately demonstrated by Strauss[8] with five and seven year cures in inoperable cancer of the rectum and by numerous workers in such delicate procedures as the repair of detachment of the retina.[9-10] Until recently the inadequacy of tonsil coagulation, then, has chiefly been due to the inability of the patient to withstand a definite amount of treatment. It is still due in great measure to faulty technic on the part of the operator.

Local Analgesia

Pain has been the chief handicap not so much during treatment since cocainization permits an adequate degree of coagulation, but postoperatively. I have used most of the local anesthetics in tonsil coagulation during the past nine years. A number of them are sufficiently effective for adequate treatment without too much immediate pain, but postoperative pain ensues too soon and is usually severe. The injection of aqueous solutions results in severe postoperative pain due to the rapid absorption of the anesthetic, and the scalding effect in distant tissue through heat transmission by the injected water.

The absorption of the anesthetic can be immensely retarded through the use of sesame or sweet almond oil as a solvent, but as the amount injected must be scattered in drops only, much time elapses before operative procedure may begin. The dispersion of heat may also be limited by the use of oil but not nearly as well as by the coagulated serum alone, which acts as an efficient insulator under topical anesthesia.

Fortunately new topical anesthetics have appeared which not only permit of extended coagulation at a sitting but insure a remarkable degree of comfort for the patient even for three days after coagulation. Butesin in carbitol is effective and gives a far better postoperative effect than cocain. Its action, however, vanishes after about thirty-six hours; while the carbitol is destructive to instruments of hard or soft rubber. Benzocaine has an action similar to butesin but is, perhaps, more irritating to tissue. Eucupin is an effective and safe anesthetic but of short duration.

The most valuable topical anesthetic thus far has proved to be diothane.[11] Since December, 1934, I have used it as a 5 per cent solution with benzyl alcohol (5 per cent) in ethyl alcohol (55 per cent) as a solvent. Recently I have used diothane (5 per cent) benzyl alcohol (20 per cent) in propylene glycol. Either one of these diothane solutions give a postoperative anesthesia of even three days duration, which is especially gratifying to patients

who have previous had only cocain as a topical anesthetic. Its action is slow and about ten to twelve minutes should elapse before coagulation is started. Twenty to thirty drops on a watch crystal or water color plate suffice if the same applicator is used in four or five applications to one side. The anesthetic should be gently rubbed on all parts of the pillars and tonsil. It is non-toxic and causes no perceptible irritation or redness. No patient so anesthetized has ever missed a day at work or a single regular meal even after extensive coagulation of massive tonsils. Adrenalin or ephedrine should not be used as these drugs prevent the penetration and efficacy of the anesthetic.

Technic of Electrocoagulation

A certain technic has been found to be essential. Coagulation should proceed from above downward so that in the average tonsil the upper third is treated, then the middle third at a subsequent treatment and only in the final treatment the very base of the tonsil. Such a procedure insures total removal and prevents bleeding. If one attacks the bulk of the tonsil a crater is formed leaving a shell of tonsil on both anterior and posterior pillars difficult to define and appearing like a score of small tonsils which can be removed piecemeal only. One cannot do a clean surgical dissection in this manner. If coagulation proceeds first along the upper plica to free the tonsil, as in tonsillectomy, and to coagulate as much as possible of the dome extending into the supra-tonsillar fossa, a more definite idea of the size and depth of the tonsil is obtained at the following sitting. Subsequent treatment not only takes care of the next portion but also is directed as a "mopping up process" to any tissues left in the previously treated area. It is absolutely essential that any plica present be removed in order to insure a clean result, since tonsil tissue dips deeply beneath it. Because there will be no shrinkage of tissue, the plica, if left, is frequently so large as not only to prevent a good view of the fossa but to leave a suspiciously ragged appearance. Since the plica is part of the pillar and therefore of the throat,[12] its removal is more painful than that of the tonsil tissue itself, just as in dental procedures the lip, cheek or tongue are much more sensitive to accidental trauma than the gums. The base of the tonsil at the site of its main blood and nerve supply is the most sensitive.

Postoperative bleeding has been a frequent objection. It occurs most frequently on the sixth to the eighth day and especially when a large portion of the base of the tonsil is coagulated. Partial occlusion of an artery leads to atrophy of the tissue it supplies. The atrophy is proportionate to the cross area occluded in the artery. Conversely removal of tissue causes a proportional diminution of the sectional area of an artery. If the base of the tonsil is coagulated only after the upper two-thirds to three-fourths of the tonsil is coagulated, there will never be any bleeding other than the brief oozing similar to that which follows the removal of a small scab from an abrasion. This is my experience in over six hundred cases. An occasional large artery in the middle lateral wall of the fossa may ooze after the second coagulation, that is of the middle third. No matter what the extent of coagulation, ten days time exactly is required for complete liquefaction and disappearance of the coagulum, final separation taking place only at the junction of the living and the coagulated tissue. Therefore two weeks should elapse between treatments on the same side. By treating alternate sides, a treatment may be given every week with only half the amount of discomfort.

Retraction of the pillar to ensure direct vision is as essential as in surgical work elsewhere. Gentleness and calm, deliberate handling of the throat and patient are prime requisites. Swelling of the proximal portion of the

palate or of the uvula should only occur when the tonsil extends well up over the posterior pillar to a short palatal arch. In my experience with minimal amperage and touching only tonsil or lymphoid tissue, swelling is very rare. Too small a current requires longer time for coagulation with resulting dispersion of the heat to remote unanesthetized tissue and needless pain. The optimal time required for each contact is about one second. This depends to some extent on the spread of the points of the electrode — when closely approximated coagulation is localized and rapid; when separated coagulation is more extensive and slower. The duoterminal electrode[13] requires less current, approximately one-half of that when the uniterminal electrode is used with the indifferent plate or autocondensation cushion. Work is much more rapid with the duoterminal electrode for the same reason that a chisel or gouge is more efficient in wood carving than a single point instrument, like an ice-pick. Pain, too, is less and the danger of coagulation or over-coagulation beyond the desired area is impossible since coagulation always extends beyond the sides and tips of the electrode, one-half the distance of their spread. Prolonging the current beyond coagulation results in a volatilization of the fluid in the coagulated tissue with an explosive effect between the electrode points but without added pain or any harm. The duoterminal electrode is therefore quite self-limiting in effect.

The postoperative condition of the fossa and pillars is remarkably free of thickening or infiltration. The pillars remain soft, elastic and undiminished in size even after six years. The fossa itself in no way resembles that following surgical tonsillectomy and in young individuals not too chronically infected, has the color of the posterior pharynx rather than the grey shining glazed appearance that follows surgery. In the very large and chronically infected tonsil of the adult where extensive outgrowths of fibrous septa reach into the tonsil between the crypts, coagulation leaves stump-like projections in the fossa with possible tonsil islands between them. Removal of these islands, however, leaves a surprisingly smooth floor with occasional firmer small areas more resistant to pressure than the surrounding tissue. Especially in the cases which previously have had peritonsillar abscess, any tonsillar tissue left in the upper poles may result, as after surgical tonsillectomy, in a recurrent abscess.

The favorable immunizing effect of the coagulated bacterial content of the crypts, first observed by Balmer, has been reported by careful observers.[14, 15] One can demonstrate this effect in cases of acute rheumatic fever, as I have done in three cases by simply coagulating the tonsils on both sides. The regression of symptoms is startling and almost immediate without the aid of any other therapeutic agent. In rapidly progressive, early osteoarthritis, where all dental foci have been removed, but the tonsils overlooked or incompletely removed surgically, the marked regression of symptoms following thorough coagulation can be often noted week by week. Strauss[8] states that never before, following any other method of treatment in cancer of the rectum, has he seen such marked rapid improvement in a patient's condition as after a single rectal electrocoagulation. Patients with Vincent's angina, who are unable to sleep for several nights and able to eat only with difficulty, obtain immediate relief and a rapid uneventful recovery following a single coagulation of a chronic ulcerated area.

The plea is for (1) further development of topical anesthesia to insure at each sitting a careful, leisurely planned, destruction of a definite portion of the tonsil. (2) Further study by the specialist in the use of a powerful agent possible of accurate control instead of the abuse of the same agent by osteopath, chiropractor and yes, even as in a case brought to my attention, a chiropodist.

For the removal of postoperative remnants and for patients who are

deemed poor surgical risks, electrocoagulation is generally considered advisable. My experience leads me to recognize two types of patients in whom electrocoagulation of tonsils is relatively contraindicated.

1. In the individual above middle age with huge tonsils and no control over gagging and no inclination to cooperate. He should take his chance with a general anesthetic and surgical tonsillectomy.

2. In the patient under fifteen years of age, unless blessed with a fine home background and a certain confidence in the operator. I have successfully coagulated tonsils in a few children twelve years of age.

In conclusion it is pointed out that in the case of the "simple tonsil" the laryngologist can obtain as thorough results with electrocoagulation as the surgeon has attained in cases of cancer of the rectum[8]; can learn to use this method as delicately and accurately as the ophthalmologist in cases of detachment of the retina[9, 10]; can be as thorough as the urologist in cases of urethral caruncle[16]; can reach the so-called "inaccessible" just as deftly as the laryngologist has done in deep laryngeal and bronchial tumors[17, 18]; can develop a technic of his own — on that can readily leave the tonsillar fossa clean and unscarred — clear of its menacing source of infection — a real tonsillextirpy.

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INVESTIGATION OF ELECTROSTATIC AND MAGNETIC FIELD OF SHORT AND ULTRASHORT WAVES (RADIATHERMY)*

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LOS ANGELES

Radiathermy has within the last two years come into general use in this country, due in great measure to the stimulus initiated by Kobak,[1] whose writings, editorials, and reviews have acquainted us with the results of investigations here and abroad and added valuable clinical information. Its extensive application in the various branches of therapy, make it imperative to investigate every possible benefit as well as danger, in order to establish the most adequate and efficient mode of treatment. In this paper I shall present briefly various clinical and experimental data of both practical and theoretical interest.

Latent Deleterious Effects

Two types of latent damaging effects must be considered. First, a pathologic condition could develop after a latent period following the apparently non-injurious application of radiathermy, as sometimes occurs in x-ray and radium treatment. In the investigation of this question 200 patients who have received over 2,000 applications with 6, 9, 18, and 23 meter wavelengths were checked six to eighteen months after treatment. In no case has any damage to the superficial tissues or internal organs appeared.

Secondly, pathologic conditions could develop in parts damaged under treatment after healing of the original injury. The occurrence, mechanism, and prevention of burns, clinical and experimental, I have discussed in a previous paper. Seven cases of burns were followed for approximately six to thirteen months. Six of these were first and second degree burns, which had healed within two weeks with little scar formation. One (case 6 of this paper reported by Dr. Berg[8]) was a third degree burn on the middle of the calf, measuring 3 by 1¾ inches with considerable sloughing of the superficial tissues. This burn, required about two months to heal. Contrary to expectation no skin graft was necessary, but the scar formed a keloid which caused considerable pain and required x-ray therapy. In all of these cases no breakdown or degeneration appeared in the scar. In a group of animals, very severe burns were produced, causing sloughing of entire extremities, ears, and tail. After demarcation and scar formation the scars remained unchanged until the death of the animals within two to ten months after the burns, from causes not related to the exposure. One animal is still alive 13 months after the exposure which was followed by a sloughing off of half of the right ear. The scar is normal and firm. The clinical and experimental results to date show that no latent deleterious effects are to be expected from exposure to intense short and ultrashort wave therapy. This is in accord with purely theoretic reasoning. The frequency band of the radio short waves (10-100 kilocycles) are but a minute fraction of the radiations (x-ray, gamma ray, ultraviolet) which produce late photochemical, physiologic, and pathologic effects.

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 11, 1935.

Influence of Ultrashort Waves on Experimental Tuberculosis

Schliephake[2] states that the tubercle bacilli, exposed in a condenser field of 4.8 meters at 53 degrees C., were killed in ten minutes, while in a water bath of the same temperature thirty minutes were required to obtain a lethal effect. Tubercle bacilli, introduced in bone marrow of the legs and fingers and various other organs were killed by the application of the above method, although a temperature of 45 degrees C. was not exceeded. In eight of ten cases of pulmonary tuberculosis, in some cases complicated by pleurisy, he claims clinical improvement evidenced by symptoms and roentgenograms. Stieböck[3] reported favorable results in tuberculosis of the skin and fistulas and improvement in an advanced case of tuberculosis of the lungs. Both authors believe in a specific electric effect of ultrashort waves on the tubercle bacillus. In a recent article Schedtler[4] contradicts this claim and assumes a simple heat effect. In his clinical material he saw favorable results only in tuberculous processes where hyperemia was indicated, as in fourteen cases of tuberculous dry pleurisy and four cases of tuberculous peritonitis and intestinal tuberculosis. In six cases of wet pleurisy and three cases of empyema, in joint, bone, and fistulous conditions, he did not have any improvement. He cautions against the application of ultrashort waves in pulmonary tuberculosis which is sensitive to all kinds of rays. Previously Schliephake[2] remarked on focal and general reactions after the treatment. In order to obtain additional data on the influence of ultrashort waves on the cause of tuberculous infection, we have subjected ten guinea pigs to various electric and electromagnetic fields of six meter ultrashort wave apparatus. The detailed protocols and discussions will be presented in a separate paper. The animals were inoculated with a culture of tubercle bacilli and treatment was begun three days later. An average of two treatments per week was given over a period of three months, each animal receiving 20 to 21 treatments of ten minutes duration. Three different methods were used:

1. *General Condenser Field.* — Three animals were placed in a two liter pyrex beaker and 6x8 inch condenser plates were placed on the top and bottom. In this way the whole body was within the electric field.

2. *Local Condenser Field.* — 3x4 inch condenser plates were placed over the back and abdomen of four animals, covering the site of the inoculation and inguinal glands. One-half inch rubber sponge was interposed between the abdomen and plate.

3. *Electromagnetic Field.* — Three animals were placed in a liter pyrex beaker. The walls of the beaker were surrounded by a solenoid consisting of seven turns of 5/8 inch copper band connected to the machine. This created an electromagnetic field within the beaker. Rectal temperature was measured before and after each treatment. Rise in rectal temperature was accomplished with all procedures, but not during every exposure. The highest rectal temperature was above 110 degrees F. Burns were avoided by measures of prevention which we have pointed out in a previous paper.[8]

Autopsy Findings. — After three months all animals were killed including the controls. Table 1 gives a summary of the experimental and autopsy findings. The autopsy results were made and conditions estimated according to the standards of Olive View Sanatorium by Dr. Loomis. Results were computed on a basis of a maximum of sixteen points for each pig (judged on the conditions of glands, spleen, liver, and lungs).

Analysis of Material. — The total points of ten treated animals was 68 compared with 70 for the controls. No striking differences in involvement were noted. The three animals treated by a general condenser field showed the smallest average of involvement. However, this appears to be purely accidental, one animal in this group showing only involvement of glands amounting

TABLE 1. — *Summary of Treatment and Autopsy Findings of 10 Guinea Pigs Infected With Tuberculosis by a 6 meter Apparatus of 150 watt output*

No.	Temp. Aver. Before Treatment	High Exp. Temp.	Aver. Exp. Temp.	High Temp. Rise	Aver. Temp. Rise	Autop. Total	Remarks
			General Condenser Field				
1.	102.4	105.0	102.9	2.6	.45	9	18 points average 6
2.	102.0	104.8	103.1	1.8	.64	1	
3.	102.8	105.5	103.2	3.45	.60	8	
			Local Condenser Field				
4.	102.4	105.6	103.5	2.35	.91	6	26 points average 6.5
5.	102.8	107.3	104.84	3.2	1.60	10	
6.	103.2	108.2	104.9	5.30	2.10	4	
7.	103.1	107.2	104.9	3.8	1.70	6	
			Electromagnetic Field				
8.	102.9	110.0	104.1	7.0	2.35	9	24 points average 8
9.	103.2	109.0	105.1	7.5	1.9	10	
10.	102.4	110.0	103.0	8.0	2.3	5	

20-21 treatments during a 3 month period.

to one point. A number of authors who ascribe the beneficial effect of ultrashort waves to a specific action stress the importance of giving a small intensity which hardly produces a rise in temperature. In this series no difference appears in the progress of tuberculous infection between animals which were heated higher and those which were not. None of the methods used in these experiments had any marked effect on the development and progress of the infection. On the other hand after twenty exposures sometimes with a marked rise in general temperature, no deleterious effects or complications appeared. While general conclusions are not warranted under the conditions of these experiments, any possible effects of ultrashort waves on tuberculosis seem, in accordance with the views of Schedtler, to be of a non-specific heating nature.

Gross and Microscopic Changes

Ten rats and ten guinea pigs exposed to six meter electric or magnetic fields were autopsied. The guinea pigs were infected with tuberculosis and treated as outlined above. They were killed after three months. At the autopsy no other changes than the typical tuberculous lesions were found. The organs were not examined histologically.

Two rats received single treatments in the condenser field or electromagnetic field at high temperatures. They died after a maximum exposure of eleven and six minutes respectively, following convulsions and coma. Four rats were exposed to local applications over the abdomen with small condenser plates. They had all suffered burns, which produced sloughing of the extremities, tails or ears. These lived from 13 to 26 days. The rectal temperature rise was moderate. Three rats were exposed to the electromagnetic field of five turns of coiled copper, ⅜ inch band over a beaker of one liter capacity. These had moderate temperature exposures. None of the rats were killed. They showed no gross changes except a pea sized abscess in the right lower lobe of the lung of one, and the after effects of the burns in four animals. In seven animals sections were made of different organs. Table 2 gives the microscopic findings.

The most constant changes were found in the testicles. These consisted of destruction of the mature spermatogenic cells and the presence of giant cells. Some hyperplasia of the Sertoli cells was present. This was independent of the degree of heating and the manner of application.

In the lungs of three animals there was some focal infiltration and a sterile abscess in one, which was under treatment for a month and received

TABLE 2. — *Autopsy Findings On Rats and Guinea Pigs Exposed to Electric and Electromagnetic Field of 6 meter waves*

Organ	Number Examined	Pathologic Changes (No.)	Type of Changes
Testes	3	3	Some destruction of mature spermatogenic cells and seminiferous tubules. Giant cells in two. Slight proliferation of Sertoli cells.
Lung	3	3	Sterile abscess in 1. Slight infiltration and congestion.
Liver	7	2	Congestion.
Heart	2	0	Normal.
Adrenals	1	0	Normal.
Brain	4	1	Slight decrease in pyramidal ganglia.

A. *Gross Changes*: 10 guinea pigs. No changes except tuberculosis. Ten rats. No changes in nine. One had a sterile, pea-sized abscess at the base of the right lung. In 4 rats slough after burns.
B. *Histological Changes*: 7 rats.

twelve applications. The liver was normal in all seven animals. Three brains were examined microscopically. In one there was some decrease in the size of the pyramidal ganglia.

The adrenals examined in one rat were normal. The ovaries examined in one rat were normal. The kidneys were normal in three animals including one which was removed in a moribund condition after nine minutes exposure in a general condenser field at a maximum of 111 degrees F. and resuscitated. Rectal temperature was over 111 degrees F. Three hours later, bloody urine with erythrocytes, granulated casts, and epithelial cells was voided. It died ten days after exposure. Jacobsen and Hosoi[5] have found analagous changes in twenty-three dogs, twenty-seven white rats, and three guinea pigs which they exposed to prolonged heating in a condenser field of a thirty meter short wave apparatus between 108 and 112 degrees F.

In my experiments with the electric and electromagnetic field of a 6 meter short wave apparatus, only two animals were exposed to above 110 degrees F. The rest had moderate or slight temperature rises. Exposure never exceeded ten minutes. Changes, however, were similar to those obtained by extreme heating and prolonged exposure in the 23 meter field by Jacobsen and Hosoi.[5] In addition giant cells mentioned also by v. Oettingen and Hook (quoted by Schliephake) were found in the seminiferous tubules. From a clinical standpoint the most important finding is the possibility of damaging the male germinal cells. It seems therefore indicated to protect the testicles when treatment is applied to this region.

Another organ in which care should be exercised during treatment is the lungs, because congestion and infiltration have been noted. On the other hand the fears of some authors that local heat accumulation may damage deep seated organs exposed to the condenser field are not supported by the autopsy findings and clinical experience.

Solenoid (Electromagnetic) Field of Short and Ultrashort Waves

The most common method of applying short and ultrashort wave energy to the body is by means of an electrostatic field set up between two insulated electrodes. In the United States, only Merriman, Holmquist, and Osborne[6] have investigated the electromagnetic field of a 25 meter wave machine (12 million cycles), of 200 watt input, called the Inductotherm. No

experimental or clinical work was done to date with the electromagnetic field of the ultrashort waves (below 10 meters), with the exception of that by Kowarschik.[7] He employed a 4.8 meter machine with 1500 watts input. Merriman and co-workers[6] claim that in the low concentrations met with in living tissues the conductivity is proportional to the concentration of the electrolytes. The Inductotherm therefore heats vascular tissues more than bone, tendon, adipose tissue, and skin. In this they see a great advantage of the electromagnetic field because the danger of overheating is lessened, the heat being rapidly dissipated by the circulation.

Kowarschik investigated the electromagnetic field of the solenoid of a 4.8 meter machine and arrived at different conclusions from those of the above named authors, who utilized a 25 meter machine. Contrary to general opinion that good conductors heat intensely in the electromagnetic field at high frequencies, he found metals to heat very little. Electrolytes and dielectrics like animal tissue, however, heated intensely. The maximum heating did not increase with the concentration but followed a curve which is characteristic of the condenser field. This was explained by Weiss[2] to be due to the fact that with ultrashort waves the solenoid acts partly as a condenser and transmits the current through the electrolytes and tissues by dielectric hysteresis rather than through the windings of the coil with their greatly increased inductive resistance.

I have investigated the characteristics of a 6 and 9 meter ultrashort wave apparatus of 150 watt output, its heating effect on electrolytes, different body tissues, and various fluids, its physiologic effect on animals, and its clinical application on myself and a number of patients.

Adaptation of a Solenoid to Ultrashort Wave Apparatus. — With the exception of the inductotherm, short and ultrashort wave apparatus are supplied only with condenser electrodes. It was necessary to find a method of adapting them to the use of a solenoid. I have found the following arrangement to be simple and effective: Two metal rods of three to four inches in length are fitted into the plugs. In order to prevent accidental contact the ends are covered with insulating material. The rods are connected by special clamps with the leads of the solenoid electrodes, or the rods have tapered holes into which tapered plugs of the solenoid leads are introduced.

Heating Effect of Electromagnetic Field on Electrolytes. — The heating effect which is primarily determined by the frequency of the current, the length of the coil, the number of turns, diameter of coil, and concentration of the solutions, was found secondarily to be influenced greatly by variation of current, the material of beaker, volume of solution, sharpness of resonance, and sparking. Detailed analysis of experimental results will be given in a separate paper.

While the majority of the heating curves approximated those described as characteristic of magnetic fields by Merriman *et al.*,[6] showing an increased heating with increased concentration, irregularities were encountered due to the secondary factors. When, however, only two rings of ⅜ inch copper band, separated by 1 inch distance and each connected to one terminal of the machine were used, intensive heating of saline solutions occurred which gave curves characteristic for the heating in condenser field quantitatively surpassing the heating of the corresponding volumes of saline by solenoids. This method corresponds to the application of cuff electrodes which was found to be an efficient mode of clinical treatment.

In heating of animal tissues with solenoids, better heating was achieved in the tissues of highest water content, such as meat, bone marrow than in more viscid tissues like fascia (table 3).

Deep penetration compared favorably with condenser fields. Maximum heating of body fluids was found in erythrocytes. Synovial fluids showed

TABLE 3. — *Heating of Meat and Bone in a 200 cc. beaker with Falconer Transtherm 6 meters 150 watts output. Solenoid height 2½ inches; diameter of coil ⅜ in. 5 turns. 5 minutes heating.*

Tissue	Dist. From Solenoid	Rise in Temp. (C.)	Remarks
Meat	1/8 in.	47	Meat coagulates at periphery,
Meat	3/8 in.	36	6/8 in. after two minutes.
Fascia	3/8 in.	24	
Bone marrow in bone 1.27 cm. thick, at periphery of meat	3/8 in.	32.5	Fat crackled and liquefied, then boiled at periphery.
Marrow in bone at center of meat	6/8 in.	12.	Juices exuded at 64 degrees
Bone alone not surrounded by meat	6/8 in.	6	C. After three minutes steam
Juices at periphery	0 in.	60	appeared.

differences in heating in accordance with their composition (table 4).

In comparative experiments on rats and guinea pigs the heating effects of the solenoid was somewhat higher than of a corresponding condenser

TABLE 4. — *Heating of 20 cc. of Various Fluids in the Electromagnetic Field* of a 6 meter Ultrashort Wave Apparatus (Per Minute)*

1 per cent saline	9.0° C.	
Pasteurized milk	8.0° C.	
Egg white	15.5° C.	
Egg yolk	15.5° C.	
Blood plasma (human)	17.0° C.	
Erythocytes	20.0° C.	
Synovial fluid	11.2° C.	Average of 4 estimates — highest, 13; lowest, 9° C.

* In a 25 cc. test tube with 7 turns of 3/8 in. copper band.

field. The rush of blood to the extremities seen in the latter was not present in the former. No burns occurred in the solenoid field. No deleterious effect on the treated animals was noted. At autopsy only mild changes in the seminiferous tubules and giant cells in the testicles were found, similar to the findings in the condenser field. The lethal dose was reached somewhat sooner in the solenoid than with the condenser.

Observations With Solenoid Fields of 6 and 9 Meters

Any short or ultrashort wave apparatus can be adapted for treatment with solenoid by inserting metal rods as outlined above.

Types of Solenoids. — We have developed in connection with the adapter rods three types of solenoids for treatment which combine efficiency in heating with simplicity and uniformity of application.

The first type is a non-flexible electrode consisting of a cylinder of insulating material about the length of a forearm (12-15 inches) and about 14 inches in diameter, around which a number of turns are wound at regular interspaces, leaving several feet of copper band at the free ends (fig. 1.). These serve as leads and are insulated with the exception of the free ends which are attached to the connecting rods of the insulated clamps. Another modification of the attachment is to have plugs fit into holes of the connecting rods. This type of solenoid is suitable for treatment of the forearm.

Fig. 1. — Arrangement showing the adaptation of a short wave apparatus to the use of a rigid solenoid electrode for the treatment of the arm.

The second type has flexible electrodes consisting of cylinders shaped to fit either an arm or a lower extremity and made of elastic insulated material such as gum-rubber. Over these cylinders the turns of copper band (3/8 inches in width) are wound as in the first type and covered with an outside cylinder of the same material. This type is satisfactory for the treatment of the upper and lower extremities.

The third is the universal type of solenoid. This consists of 12 to 14 feet of insulated copper bands like those of Kowarschik's.[7] In order, however, to obtain a speedy winding of these turns on the limb and to secure them in position with equal spacing we have constructed spacers, consisting of strips of insulating and flexible material, such as sponge rubber which is notched at regular intervals. The notches correspond to the width of the insulated metal strips. The spacers are secured by elastic bands and the strips are engaged in notches. The regulation of the distance between the body and the bands is effected by the interposition of plain strips of variable thickness between the skin and spacers. These solenoids are suitable for treatment of the torso, the neck, and abnormal configurations of the limbs, not permitting application of the other two types. Application of the other two types necessitates padding to the treated parts by means of towels or other absorbent material. With this arrangement of solenoids, adapters and connectors we have been able to utilize different commercial apparatus for treatment with the three types of solenoids, and to obtain satisfactory heating and clinical results.

The outstanding sensation during treatment is one of deep penetrating heat surging through the limb. The skin after treatment does not appear markedly red, but is warm to touch, with moderate perspiration. The elevation of skin temperature lasts about one-half hour.

Several other phenomena were encountered within the solenoid field. Conspicuous among these were deep nagging, painful sensations. These did not occur with the same intensity in all persons. Some patients were so sensitive as not to bear even the lowest intensity of the field. While I am unable at present to explain the cause or significance of this sensation, I have found it advantageous as a danger sign. The intensity must be reduced or the treatment entirely discontinued. In fact, patients that had these sensations at low intensities showed also other symptoms of incompatibility with the treatment, such as vertigo. These symptoms occurred

especially in patients with abnormally low or high blood pressures. It was interesting in the case of one patient to note that when the treatment was given over the left arm she had fainting spells on two successive occasions, though she could stand ten minutes' treatment over the right arm.

Table 5 shows the results of 18 cases treated by the solenoid field of

TABLE 5. — *Summary of Results with the Solenoid Field of a 6 and 9 meter wavelength*

Diagnosis	No. of Cases	No. of Treat.	Subj. Impr.	Obj. Impr.	No. Impr.	Remarks
Raynaud's Disease	3	10	3	3	0	1 patient showed drop of 20 mm. blood pressure after treatment.
Peripheral Arteriosclerotic Circulatory Disturbances	4	3–10	3	2	1	
Vaso-Neurosis Hypotension	3	1– 4	0	0	3	Treatment discontinued because of fainting.
Infectious Arthritis	3	2–10	2	1	1	
Brachial Neuralgia	3	4– 5	3	2	0	
Spastic Wry Neck	1	1	0	0	1	Hypertension, treatment discontinued.
Tuberculosis (Knee)	1	3	0	0	1	Treatment discontinued.
	18	....	11	8	7	

6 and 9 meter waves. Ten cases were treated for symptoms of deficient peripheral circulation. Three cases were diagnosed as Raynaud's disease. In these cases marked subjective and objective improvement occurred after ten treatments. Four cases of deficient circulation were due to arteriosclerotic changes with cramps and pain on walking and claudication. Two of these improved objectively and three showed subjective improvement. In contradistinction to the good results in these cases is the failure in vasoneurotic symptoms in three young women. They all had hypotension with a blood pressure below 110, vague pains in the extremities, complaints of cold feet and perspiration. There was evidence of deficient thyroid and ovarian function in these patients. One of them had been operated on for Grave's disease. In all cases the treatment had to be discontinued because of incompatibility due to dizziness, fainting, and nagging pains even with the mildest intensities.

Two out of three cases of infectious arthritis showed a decrease of pain and stiffness of the joints. Here the treatment was only given as an adjunct to other therapy.

Three patients with brachial neuralgia were treated with good results, two of whom previously had been treated in the condenser field of ultrashort wave without benefit. In one individual with spastic wry neck and hypertension the treatment was not tolerated and had to be stopped. One patient with tuberculosis of the knee joint discontinued after three treatments. Of the total of 18 patients, 11 showed subjective improvement, 8 were objectively improved, and 7 were not improved. This includes the two patients of spastic wry neck and tuberculosis, and three patients of vasoneurosis where the treatment was discontinued after one to four applications. The greatest benefit seems therefore to be obtained in disturbances of peripheral circulation and neuralgia. The limited number of observations and the shortness of time since the introduction of the treatment (about six months) render it inexpedient to draw any definite conclusions.

The solenoid is a modality of short and ultrashort wave therapy which in some instances, such as the treatment of extremities, appears to be more

convenient and effective than the condenser field. With my method of adaptation and with the different types of solenoids, each short wave apparatus equipped for condenser field treatment can inexpensively and simply be modified to treatment with solenoids.

Summary and Conclusions

1. A simple method of adapting short and ultrashort wave apparatus for treatment with solenoids is presented.

2. Two hundred patients who had received short and ultrashort wave treatment were rechecked, and no symptoms of any latent damage were discovered within 6 to 8 months. Likewise no latent damage was found in a group of animals which had been subjected to short and ultrashort wave treatment.

3. Clinical and experimental burns caused by short and ultrashort wave application healed with firm normal scars; no degeneration developed in the scars of patients and animals.

4. No influence on the course of tuberculous infection was found at autopsy in ten guinea pigs treated with local or general condenser and solenoid fields.

5. Gross and microscopic examination of the organs of ten guinea pigs and ten rats treated with the three modalities of short and ultrashort wave apparatus showed as the most conspicuous changes degeneration of the spermatogenic cells and giant cells in the testes, congestion and peribronchial infiltration of the lungs.

6. The heating effect of various solenoids on different volumes and concentrations of electrolytes and on colloids, including body fluids, was studied.

7. The influence of primary and secondary factors on the heating effect of the solenoid on various fluids and tissues was noted.

8. Three types of solenoids are described which permit efficient treatment of any part of the body of normal or abnormal configuration.

9. The results of 18 cases are presented. Eleven were improved subjectively, 8 objectively, and 7 were not improved. Seven cases of organic deficiency of peripheral circulation and three cases of brachial neuritis were improved.

10. In some conditions and for the extremities the solenoid treatment seems more efficient and convenient than the condenser field.

Note: I express my appreciation to Dr. Disraeli Kobak for the personal interest he has taken in my work.

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Discussion of Papers of Drs. A. Bachem* and D. H. Kling

Dr. Disraeli Kobak (Chicago): I intend to stress one topic presented in the symposium by Bachem, namely, selectivity. Before doing so I should like to take issue with a certain allusion by one of the speakers. Let us not overlook that the discovery of galvanism in 1791, followed by that of faradism about half a century later, and the subsequent enunciations of the electromagnetic spectrum by Clerk Maxwell, which later were confirmed by Hertz, finally d'Arsonval's epochal labors with the high frequency current, climaxed by the biologic studies of the short and ultrashort waves, have all been accepted today as scientifically sound in principle and therapeutically effective. Accordingly the somewhat hypercritical remark that in physical medicine there is a tendency to create false gods is certainly not justified by the facts. Perhaps Bergonié's aphorism to the effect that physical medicine has arrived too soon for a profession too young, properly characterizes our attempts to adapt ourselves to phenomena too complex for ready understanding. Based on critical analysis of known facts one does not have to be endowed with prophetic gifts to assert that short wave therapy will in the not too distant future be generally recognized as one of the most valued contributions to medicine.

As regards selectivity it was about ten years ago that Gosset and his coworkers demonstrated that granulomas in geranium plants produced by the Bacillus tumefaciens, were eliminated by a 2 meter wavelength. As early as in 1926 Esau demonstrated a special point heating when alkalinized water emulsified by paraffin oil was subjected to ultrashort waves. In his experiments he showed conclusively that boiling of such a mixture was attained by a temperature of 50 to 60 degrees C., that is about 50 per cent below that of the boiling point.

Concerning the selective heating effect, Pätzold demonstrated the heating of electrolytes with ultrashort waves. He showed that the calorific effect depended directly on frequency. The higher the frequency, that is the shorter the wavelength, the greater the selectivity on certain types of electrolytes and metabolites. Other pioneers abroad also have demonstrated the value of ultrashort and short waves, but this is mentioned merely to show that we actually have neglected an opportunity to make short and ultrashort wave radiation a contribution of American science. Schereschewsky was perhaps the first to demonstrate it in biologic material, but it took our colleagues abroad to show its efficacy for therapeutic purposes. It is a reproach that even such workers as Szymanowsky and Hicks in America, who were among the earliest to point out the effect of ultrashort waves on diphtheria toxins, went virtually unrecognized, until Recknagel and Schliephake demonstrated a similar effect. Instead of using toxins, the latter irradiated diphtheria antitoxin. They proved that when a series of animals were injected with a fatal dose of diphtheria toxin and antitoxin was given, these animals naturally were saved, but when the antitoxin was irradiated with a 3 meter wavelength for three-quarters of an hour the serum lost its antitoxic power and the animals died. Jorns also contributed striking information to this problem. He showed that marked phagocytosis was an inherent property of ultrashort irradiation and regarded it as a specific action of the condenser field.

One of the most scientific demonstrations of the value of ultrashort and short waves was that of Pflomm who, in 1931, showed beyond doubt the prolonged vasodilating action of these electric fields.

As regards selective action, one must mention the work of Izar and Moretti who, in 1933, showed an increase in the non-specific, anti-complementary powers in syphilitic serum when exposed to heat by 15, 7, and 8 meters. The 4-meter wavelength apparently had a greater effect on this state than the 15-meter. They showed that agglutinin titer of fresh human serum against typhoid bacilli was lowered with ultrashort but not with short waves. From what has been said it is clear that the selective effect of ultrashort waves is no longer a theory, but as Bachem pointed out, an accomplished fact.

In conclusion I cannot refrain from pointing out that American medicine though slow in recognizing the fundamental labors of Schereschewsky, has by no means been slow in attempting to confirm some of the thermic and selective claims emanating from abroad. Experience has already taught that short and ultrashort radiation produce thermic penetration effects distinctly different from those obtained by conventional diathermy. It therefore is unfortunate that we have coupled the two under a hyphenated union. And just as it has been pointed out that the Holy Roman Empire was neither holy, Roman, nor an empire, so short wave diathermy is neither short wave, nor diathermy in action or scientific principle. It must be either one or the other. The terminology may be questioned but not the action. Kling's constructive studies with reference to burns and how to prevent them, and especially his emphasis of the usefulness of the solenoid method with capacity cables has been a stimulating contribution. He has pointed out a practical method of short wave application that holds out promise of clinical benefits, benefits that have already been demonstrated in diseases in which diathermy is contraindicated. I am confident that further studies will bear out my persistent contention that short wave is not diathermy and that it will replace diathermy because of certain inherent properties absent in the latter.

* Dr. A. Bachem's paper appeared in the November, 1935 issue of the ARCHIVES.

Dr. W. J. Egan (Milwaukee): I would like to ask Dr. Kling if, in the postmortems of his guinea pigs or rats he examined the spinal cords and brains of these animals. Yesterday, at a sectional meeting, I presented a report of the results of 4,854 treatments in 451 patients administered in my office and at the County Hospital at Milwaukee. I submit our observations that will possibly cover the field. We treated a series of 74 to 76 carbuncles and furuncles of the nose. These furuncles were also on the neck, back, buttocks, and the like. The next series was 43 acute infections, our two main problems from the beginning. We have learned a few lessons. Clinical judgment is just as essential in the management of short wave therapy as in the administration of drugs.

We did have burns. We had three, but they were superficial and not particularly bad. Patients know that we make use of an electrical instrument and merely a feeling of comfortable warmth in the affected part. Some of them will not say it stings or hurts, because they have been "shocked" before and anticipate some unpleasant sensation. All patients should be properly instructed that any sensation other than pleasant warmth must be reported.

The technic to use is the shortest possible treatment for a skin lesion, for a carbuncle, having the point of heat over the lesion. We have had patients with furuncles of the nose tell us they feel as if a boring needle is inserted. Our length of treatment has been ten minutes. There are only two ways to avoid burns: Constant vigilance. No attendant is allowed to leave the patient even for an instant. Care of perspiration, particularly on hot days. We try to avoid, whenever possible, the use of towels, felt, and the like. We try to have the body exposed to the condenser plate electrode with the use of a simple piece of absorbing paper. In these acute lesions we have had our best results in those who have had the most analgesic effect.

When we deal with a large carbuncle such as one sees sometimes in the back of the neck, treatment is immediately instituted, and the next day there should be a demarcation between the pathologic lesion and a normal reaction. If lymphangitic streaking is present, it should be diminished the next day and toned down in color. Scarring is practically negligible. It is a pleasure to take care of carbuncles by this method of therapy, particularly in women anxious to avoid scars and deformities.

Puerperal breast abscesses, of which we have had only six are greatly benefited by treatment with an efficient apparatus and proper technic. Five have been treated or are in process of treatment at home now. The results are very gratifying. I know of nothing that has given us more satisfaction than avoiding incisions of the breast in our cases treated to date.

Dr. William Bierman (New York): I want to call your attention to what I consider a few of the important principles in this problem of the short wave currents. To illustrate some of the problems presented by the speakers this afternoon, I must turn to the physicist for some of his considerations in order to afford us a fair degree of logic as to what we are doing. There has been considerable discussion as to the comparative heating effects of various technics. If we apply the condenser plate at some distance from the tissue to be heated, we will get an electric field which, one might say, bellies out, and then a further dispersion within the tissue. This work has been done by our physicist (it is not my own) who has mapped out these electric fields. We get essentially the same effect as if a metal plate is placed in contact with the skin for the administration of diathermy. Application of the condenser plates so that they present a relatively large surface in contrast to the region to be heated, results in a convergence of the lines of current energy with a great degree of heating within the tissue. Mr. Breitwieser referred to that when he said that in the treatment of shin bone conditions he has found that clinically. It interested me that he, as a physicist, had observed this clinically. If he put a large plate underneath the foot and another higher up, he got more effective results than if he used the lateral technic. I think this explains the deeper heating. It also explains some of the things to which Dr. Kling called our attention.

We have studied the temperatures produced within living human tissue of the quadriceps extensors, or muscles of the thigh, using the cuff technic. One cuff is wrapped around the lower part of the thigh near the knee, and the other is placed as high up as we could attain conveniently. About the region equi-distant from the nearest cuff edge thermocouple needles are inserted. One thermocouple needle is a short distance away from the bone, with another thermocouple needle in the subcutaneous tissue. We also insert thermocouple needles underneath the subcutaneous tissue. We take the skin surface temperature, and the temperature of the skin surface underneath the cuff. As a result of such temperature determinations, in contrasting the temperatures produced by diathermy using the cuff technic (to which we called attention, by the way, two and one-half or three years ago in a paper which appeared in the ARCHIVES) with the short wave current, we find we get a rise. The temperature of the intramuscular tensors in the quadriceps tensor muscles rose from about 99 to 107 degrees F. The temperature determinations are taken while the current is off, not while it is flowing. The initial determination is taken before, and after the current has been applied for about twenty minutes it is discontinued and the needles are then inserted again into relatively the same area. There is a very substantial rise which rapidly falls. In diathermy we also get a rise, which is not quite as high.

The temperature of the subcutaneous tissues will rise from about 95 to 101 degrees. We have done this now (in the series of almost 55 instances) upon living human subjects, and we get essentially these same figures in all our determinations, so there is no reasonable error that can enter into our calculations. With diathermy current we get a rise in the subcutaneous tissue to relatively the same degree. In the skin, we had a little higher rise. It depends a good deal on the tolerance of the individual, of course. In actual temperature we get a rise up to as high as 107 degrees in the quadriceps tensor muscles, muscles of the thigh, an inch to an inch and one-half beneath the skin surface.

This does not negate what Dr. Bachem has pointed out, that when it comes to selective heating of various tissues, muscle is heated less than any other tissue. It is a question of the distribution of current energy in that instance; not so much the actual heating of various tissues as the distribution of the field. Naturally, the more current there is in the muscle, the more it will heat up. With very little or no current in fat, it will not heat up.

We took the cross section of the thigh of a cow, cut off a section about an inch or so in thickness and applied the condenser plates on either side. Also, we applied the diathermy plates. The point which I consider of considerable importance is: In animals you have tissues of different electrical resistances and different electrical conductivities. What you have is not a homogenous tissue from the electrical point of view, but heterogeneous tissue. The actual temperatures as determined in this piece of excised tissue after the application of the short wave electric current were pretty much the same throughout most of the section of meat, about forty degrees C. Within the bone marrow we find there is about ten degrees less temperature, whereas when we applied the diathermy plates on either side, we found it was 42 near the plate, and 15 inside the bone marrow, which was about the temperature of this piece of meat. This shows that when it comes to the heating of tissues heterogeneous in their character, we get a more even distribution of heat by means of the short wave currents, because the question is not merely one of ohmic resistance but of displacement currents. That, I am sure, is exceedingly important.

There are many other considerations to which we can refer specifically from the remarks of the various speakers.

We should have due respect for the fact that in the possession of a heating agent such as this, we probably possess some medicine which is just as valuable as the most valuable of drugs. If, from the pharmacologic point of view, we can permit ourselves a large number of gods, we should permit ourselves as many from the physical point of view. This is not monotheism in our therapy. It is polytheism in pharmacy, and it is just as true polytheism in physical medicine.

NEW ELECTRODE TECHNIC FOR THERAPEUTIC IONIZATION (IONTOPHORESIS) *

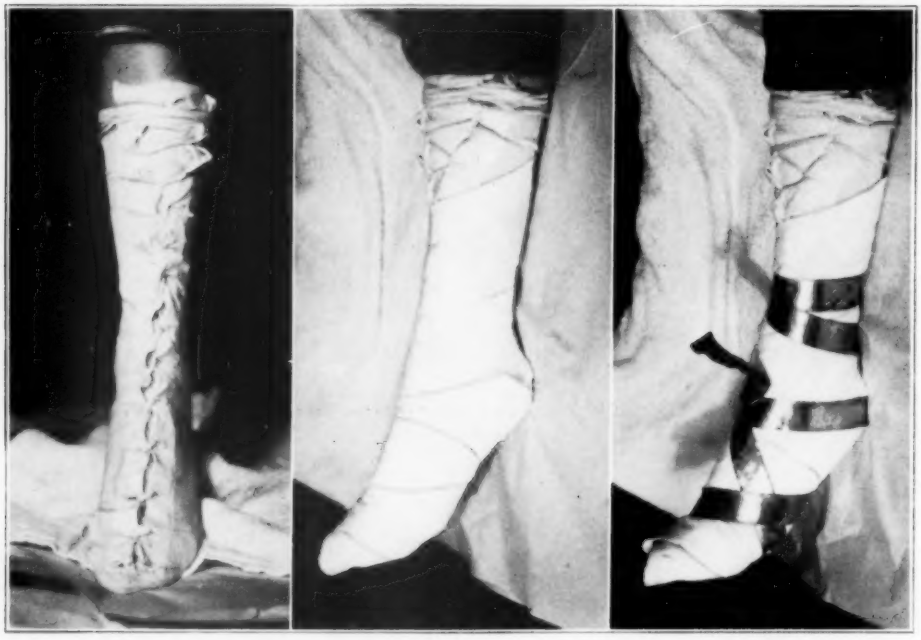
SIMON BENSON, Ph.D.

CHICAGO

As far as we know, the electrodes used heretofore in iontophoresis have been constructed chiefly out of asbestos material. However, because of its tendency to tear and fall apart into small fragments, the latter material was extremely difficult to handle. In fact, once the material was thoroughly moistened, it would tear under its own weight, and the application of such a loose, spongy, amorphous mass proved quite tedious. Furthermore, whenever the number of patients is large enough to require the immediate reapplication of the asbestos electrode on another patient, one must consider also the sanitary aspect. This is particularly true when the solution used is sufficiently expensive to prohibit a new supply for each patient, as is for example the case with mecholyl. Under such conditions, the electrode material must be removed very cautiously from one patient, then re-soaked in the solution used, and finally re-applied on the next patient. Even if the

* The author wishes to express his thanks to Dr. Samuel Perlow and Mr. Theodore Cohn for their help and cooperation in trying out this new technic.

* The material (mecholyl) and the apparatus (Ionophore) necessary to carry out these experiments have been supplied by the Merck Co., and the Burdick Corporation respectively.



a. b. c.

Fig. 1. — (a) Illustrates how the sock is laced on. There is a "tongue" right under the lacing, thus ensuring good contact between the sock material and the skin at all points; (b) After the wet flannel strip "feeder" has been wound around the sock; (c) Shows the way we generally applied the metallic electrode on top of the wet flannel. The perpendicular end of the electrode is permitted to extend through the next wrapping, and then serves as contact point for the wire from the machine.

price would permit, the solution contained in the asbestos electrode at the end of the treatment could not be squeezed out because such procedure would put the material into such a shapeless mass that it would be entirely unfit for further use.

It appears, therefore that there are three or more distinct problems connected with the electrodes as used in iontophoresis: 1. The time factor, that is, the ease with which the electrodes may be applied, removed and reapplied. 2. The sanitary factor, involving the immediate application of the electrode material to another patient. This also involves a psychic factor, because even though the sanitary problems involved be solved, one must still consider the impression likely to be left on the patient's mind were he to realize that the material being applied on his skin had just been removed from the body of another patient. 3. The economic factor, involving the cost and waste of the solution used.

Our new technic overcomes, we believe, all three of the above problems quite satisfactorily. The electrode material next to the skin consists of a white cotton sock — or a cut-off stocking — which has been cut open in front, and may be laced on similarly as a shoe (fig. 1.-a). This ensures a complete contact with the skin of the treated area. The sock is thoroughly moistened before it is applied, but it need not be dripping wet since the subsequent flannel wrappings (fig. 1.-b) will "feed" the required fluid to the sock. The flannel wrapping, which is merely a strip of flannel of any suitable width and length, is thoroughly soaked in the solution before it is wound around the sock. It serves two distinct functions: First, it acts as a fluid reservoir feeding all fluid required to the underlying sock; and second, it forms a protection between the skin and the metal electrode (fig. 1-c). There is, as far as we can see, no need to apply the metal electrode according to any definite pattern, as the well moistened flannel serves to distribute the current over the entire area. Finally the entire electrode as

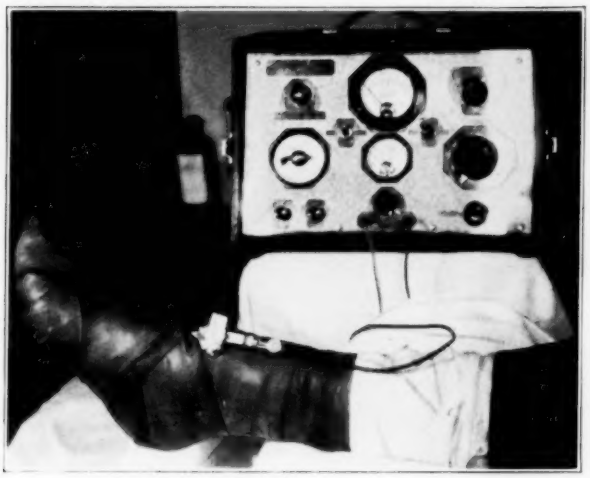


Fig. 2. — The pure rubber bandage has now been applied, the machine connected up to the metallic electrode, and everything is set for the beginning of the treatment.

now applied, is wrapped with a pure rubber bandage of any convenient width and length (fig. 2.). This helps to hold the material firmly against the skin, and also prevents evaporation of the fluid. It is obvious, that the only part in contact with the skin of the patient is the cotton sock, and the solution which is absorbed in it. This solution, however, is quantitatively very small and may be discarded without much financial loss. The sock may be easily sterilized by boiling or any other accepted method. By having two socks in readiness, one may be sterilized while the other is in use. It might be well to sterilize the flannel after each day's use, but there should be no need of doing so after each treatment, as it does not come in direct contact with the patient's skin. At the end of the day, the solution in the flannel may be saved for the next day if so desired. In treating a knee or elbow, one may use in place of the cotton sock, the legging of an ordinary white cotton stockings, or some type of an orthopedic legging; while for a hand, we suggest the use of white cotton gloves as electrode material next to the skin.

Dept. Physiology, University of Chicago.

SCIENCE, NEWS, COMMENTS

American Registry of Physical Therapy Technicians

The first official certificates of registration have now been issued to all successful candidates passed by the Board of the Registry.

Announcement is made of the next official examination to be conducted by the Board in New York during the 15th annual session of the American Congress of Physical Therapy. This examination, which will consist of practical, oral and written questions will be held at The Waldorf-Astoria, Monday morning, September 7, 1936. No applicant will be admitted for examination whose credentials have not been approved by the board. Applications should be sent at least one month prior to the date of the examination to the office of the Registrar. Further details will be found elsewhere in this issue.

London Officially Honors Sixth International Congress of Physical Medicine

On the evening of May 12th members of the executive and delegates to the Sixth International Congress of Physical Medicine were entertained at dinner in the Guildhall by the Public Health Committee of the Corporation of the City of London. Mr. Gerald McDonald was in the chair, and the Lord Mayor and Sheriffs attended.

Captain G. S. Elliston, M.P., proposing the toast of "The Guests," recalled the great part played by the City Guilds in promoting the science and art of medicine during the past six hundred years, and in particular the services of the Grocers' Company, the Barbers' Company, and the Society of Apothecaries. It seemed, therefore, right and proper that the leaders of medical science should return to the Guildhall from time to time to report progress. The City delighted to entertain that night representatives of the new branches of practice which had arisen in this century and now played so important a part in the work of healing. True to their traditional faith in the proper regulation of medical practice, the citizens of London were glad to know that these modern specialties were being developed in connection with the universities and medical schools. Failing such recognition these methods of treatments might have been grievously exploited by the type of charlatans who in former days were suppressed by the City Guilds. It was especially satisfactory that at the request of the British Medical Association the Society of Apothecaries now maintained a Register of Bio-Physical Assistants qualified to dispense heat, light, and other physical treatments when prescribed by medical practitioners.

Sir Robert Stanton Woods, president of the Congress, responding to the toast, spoke in deep appreciation of the hospitable welcome given by the City and of Captain Ellison's understanding speech. Sir Leonard Hill urged the need for the creation of a National Institute of Physical Medicine for teaching and research. Professor I. Gunzburg (Antwerp), referring in the great advances made by physical medicine since the first congress in 1905, said "We have grown up." Dr. Richard Kovács (New York) acknowledged with gratitude the hospitality of the City, and said how happy he was that the congress was meeting in a free country. Sir Henry Gauvain, proposing the toast, of "The Lord Mayor, Sheriffs, and the Corporation of the City of London," laid stress on the value of coming together on social occasions such as this, and expressed his own debt to a well-loved Lord Mayor, the late Sir William Treloar. The Lord Mayor replied, and Mr. Ernest Ebblewhite honorary treasurer of the congress, thanked the chairman and Public Health Committee for their support and generous entertainment. — [Brit. J. Phys. Med. **10**:1014 (May 16) 1936.]

Poison May be Factor in Causing Pernicious Anemia

While liver extract has conquered pernicious anemia as a fatal disease, new research by Drs. G. E. Wakerlin and H. D. Bruner, of the University of Louisville School of Medicine, may hold the promise of improved understanding of its cause.

Drs. Wakerlin and Bruner believe that the old idea of a poison factor in the disease's cause may have been right. They give research findings (*Science*, Nov. 22) that "throw doubt on the current deficiency theory as a complete explanation of the pathogenesis of pernicious anemia."

Kidney excretions from pernicious anemia patients before treatment contain two substances, they report. One of these substances poisons pigeons; but before it poisons them it produces a dangerous decrease in the reticulocytes or young red cells of their blood. The other substance is relatively non-poisonous and stimulates the production of these young red cells. The excretions from normal persons and from pernicious anemia patients after treatment with liver extract do not contain the poisonous substance.

From this Drs. Wakerlin and Bruner conclude that the old idea of a poison being the cause of pernicious anemia may be correct. The poison, they believe, cuts down the production of red blood cells by its action on bone marrow.

If this theory is correct, they suggest that it may be possible to obtain enough of the poison to produce pernicious anemia in animals like the dog for further study of the disease and its cause. — *Science News Letter.*

(*Concluded on page 374*)

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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EDITORIALS

PROBLEMS OF TISSUE HEATING BY SHORT WAVE RADIATION

Since the introduction of exceedingly high frequencies in medicine by Schliephake, designated by him as short wave therapy, biophysicists and clinicians have been agitating the problem of possible special effects of certain ranges of wavelengths. For therapeutic purposes wavelengths from 30 to 6 meters comprise the domain of radiation in contrast to the longer wavelength of conventional diathermy. The difference between these two types of electrothermotherapy is sufficiently marked to have caused most authorities to regard them as related, but otherwise entirely different modalities. Although it is generally conceded that both types of therapy influence disease through the creation of heat in the tissues, there are manifest biologic and physical differences which place the two modalities in separate classes. Clinically the more recent addition to therapy has opened a wider and more flexible field of indications.

Like many discoveries in medicine that had not been employed long enough for the laboratory and the clinic to settle moot problems, short wave therapy still leaves open a number of questions pertaining to the nature, action and biophysical effects of different wavelengths. These questions have been subjected to ingenious research by Schliephake and other competent and critical investigators in Continental Europe. In America, too, this particular problem is being subjected to laboratory experiments and clinical tests, partly to check on the labors already reported and partly to attain independent orientation. Particularly the problem of wavelength in relation to thermic penetration has received considerable attention. Of especial importance to the American profession is the fact that the group of men constituting the Council on Physical Therapy of the American Medical Association have earnestly utilized their resources for the investigation of the problem under discussion. Seemingly the conclusions they have reached

differ from the findings reported by the European investigators, a situation likely to create a false impression among physicians interested in the clinical application of this procedure.

The latest pronouncement on this problem under the authorship of Coulter and Carter[1] has just appeared, and conveys the idea that Schliephake's experiments, to mention only the leading European pioneer, are unsatisfactory because they have been carried out under conditions which can have little if any applicability to actual practice. The inference implied by the authors is to the effect that none of the critical students of this subject has investigated the heating properties of different wavelengths on other than "dead tissues and agar-agar solutions." As a matter of fact an astonishing amount of research has been done on living material and living humans. Stress has been made that the human thigh has been neglected. Why a limited and particular part of the body has been singled out as an object of study when there is available evidence far more reaching in scope and implication, is not clear. So far as heating by short waves is concerned, it is generally accepted that this is produced by a field effect not necessarily in contact with the tissue. The human body is regarded as a dielectric in which heating is attained not by ohmic resistance alone but also by impedance, that is by the sum of ohmic and capacitive resistance, in contrast to diathermy which produces tissue heating by the current flowing through them from each electrode. This contrasting action has been so clearly established by authoritative workers that it is improper to couple the two modalities into what will eventually be regarded as a hyphenated and unhappy union.

Scientific medicine has long ago accepted the authoritative findings of the laboratory as of greatest importance as an aid and guide in its struggle with disease. Physiologists working with chemicals, and dead and living animals, have correlated their experience for the benefit of the bedside problems with which the profession is daily confronted. *In vitro* studies of the blood have given us certain indices of the changes taking place in the living organism that cannot be ignored. A shift of certain metabolites from the blood to tissues or from the tissues to the blood determined by studies of the fluids outside of the body, is of great diagnostic and clinical significance. The changes observed in the constituents of the blood, the Wassermann reaction, the blood count and the sedimentation rate, to mention but a few of the important contributions to modern medicine, are important diagnostic factors and cannot be disregarded, even though most of these classic contributions have originated from the study of inert and dead material. The fact that this parallelism was introduced in the study of short wave radiation is evidence that the pioneers appreciated the validity and importance of the results of such research, and that they attempted to evaluate the effects under the most critical scientific régime.

Schliephake's[2] contributions are especially pertinent and exact, contrary to the statements of Coulter and Carter, because they deal not only with dead, but also living humans and living animals, and are as broad in scope as they are conservative in interpretation. The living humans and animals subjected by him to the short wave condenser field manifested greater and deeper heating than with conventional diathermy. In the living human his studies were directed towards an evaluation of the relative thermic changes observed in the stomach, the renal pelvis and the esophagus, as compared with those of diathermy. In living dogs he found that bone heated up strongest and subcutaneous tissue weakest. The head of a living rabbit placed in a condenser field revealed highest heating in the brain and lowest in the subcutaneous region. And to render his study more inclusive, further ob-

servations made on the limbs of dead humans showed that heating was greater near the surface than in the interior, an effect opposite to that obtained in living subjects.

It is regrettable that Coulter and Carter in attempting to prove heating of living tissues have inadvertently overlooked the important data of Schliephake's work above recapitulated, and dismissed the works of others as not pertinent to their thesis. It must not be forgotten that the pioneers have pointed out selective heating when variable wavelengths were employed on inert material. It is felt that the conclusions of the authors might have been more impressive had they not only included the latest experiments published in the foreign literature, but also duplicated those they have utilized in every technical detail. By this is meant an exact reproduction of apparatus, wavelength, electrodes and technics. Let us assume for comparison that an expert surgeon after many trials devises an important surgical procedure. Can it be expected that from a mere description of his technic any surgeon will be able to duplicate his results? The same holds good with the studies involving short wave effects. Is it unreasonable to demand that for the establishment of certain comparisons or for the verification of the striking contributions at hand, one must duplicate every step in the concerned processes?

Apart from the heating effects as such, the authors have endeavored to show that there is virtually no difference in the heating quality of the various wavelengths studied by them. Granting that this is so, it is not yet established that there is also no difference in the clinical effects. It seems that the authors attribute a claim to Schliephake contrary to that maintained by him. Conceding the great importance of the investigations made by them from the laboratory point of view, they are not in direct opposition to the assertions of Schliephake. Careful perusal of his monographs in the original texts clearly shows that he admits the presence of three variables which have not yet been definitely determined — the time factor in treatment, the field strength in dosage, and the wavelength for clinical application. What Schliephake and others did state was that there is reason to assume a probable difference in the clinical effects of the various ranges of wavelength, and that the 6 meter wavelength appears to be the one most generally applicable in therapy.

There is no question that in America no one more than the Council on Physical Therapy, in this instance under the leadership of Coulter and Carter, has attempted the study of the concerned problems more assiduously with a view of shedding light on the characteristics and effects of short wave diathermy. It is hoped that in the future these authors will correlate their efforts along established lines with those who have already enriched our knowledge concerning a therapeutic method which in spite of its newness, has been accepted as one of the most effective modalities in physical medicine.

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2. Schliephake, E.: Short Wave Therapy, English Ed. London, The Actinic Press, 1935, Pp. 84-89.

MEETING OF THE EASTERN SECTION

The spring session of the eastern section of the American Congress of Physical Therapy was held on May 27, 28 at Philadelphia, with an evening program arranged as a joint meeting with the Philadelphia County Medical Society. The attendance was even larger than was anticipated, many members and visitors having come from New York, the surrounding states and cities, to participate in the proceedings. All manifested a profound interest in the addresses and dis-

cussions. Nine formal papers were presented, each eliciting lively and informative discussions. Of especial interest was an excellent presentation by McGuinness on the important subject of overtreatment with physical agents. Her address was not only timely, but a most weighty exposure of charlatanry, incompetence and abuse of physical therapy by laymen and lay women, which tend to discredit scientific therapy at the hands of trained, conscientious physicians. Another timely subject that proved of particular interest because so far it has been slighted in America, was submitted by Weiss on the therapy of orthopedic conditions, with especial reference to fango packs. Titus discussed the treatment of erysipelas with ultraviolet energy and brought out a number of valuable points based on his large experience. The titles of the other papers having been published in the ARCHIVES need not be enumerated here. Suffice it to say that all without exception evidenced high scholarship and exact clinical studies. From a purely clinical point of view, the actual work demonstrated by Philadelphia members in the Jefferson Hospital was unusually interesting and informative. A fine spirit prevailed throughout the session, which may safely be accepted as a good omen for the success of the forthcoming fifteenth annual session of the national body in New York, early in September. The officials in charge of the eastern meeting deserve the hearty appreciation of the Congress, for they have not only systematically planned and worked for its success, but have succeeded in arousing a splendid enthusiasm for the scientific and clinical progress of our discipline.

NOTES ON FIFTEENTH ANNUAL CLINICAL AND SCIENTIFIC SESSION

The time for the fifteenth annual session drawing near, plans are being completed in anticipation of one of the largest and best meetings in the history of the Congress. With the aid of the New York Physical Therapy Society and the interest generally manifested in this year's session, there should be no question in the minds of those who reside in distant parts that a journey to New York in September will prove highly profitable.

The sectional meetings have been extended, with separate sessions to be conducted in hydrotherapy, exercise, iontophoresis and vascular conditions. Fever therapy, short wave, light and low voltage currents will be adequately represented, while arthritis, always a popular subject, will be discussed from various aspects. The section on eye, ear, nose and throat will have two full days of scientific papers with many new subjects presented for the first time.

Of special interest is the educational conference to which has been given over the afternoon of the first day. Numerous important phases of physical therapy education and training will be discussed in a symposium, followed by an open forum. Technicians, assistants and teachers of physical therapy and physical education should find the educational conference of unusual interest and value. Its aim is to bring together all active workers in physical therapy for the exchange of ideas, airing of problems and constructive improvement of programs of instruction in physical therapy and allied sciences.

One of the outstanding features of the convention will be the scientific exhibits. This important addition to the convention activities during the past two years has met with such favor that extra efforts have been made to increase and diversify the number of exhibits. As a result arrangements have been made for more than forty scientific exhibits, which with the large number of technical displays will afford visitors to the session much material for observation and study.

Physicians and technicians who are planning to attend the annual meeting are urged to make hotel reservations as early as possible. The Waldorf-Astoria, which will be the official headquarters, has ample facilities to ac-

commodate all the activities of the convention. The management will gladly make reservations in accordance with one's suggestions. The Waldorf is one of America's finest hostelries, modern in every particular. The meeting rooms are air-conditioned, assuring personal comfort regardless of the outside temperature.

The Convention Committee urges members and guests to bring their families to New York. Needless to say there is sufficient in this metropolis to keep the members of one's family interested and entertained while attending the scientific meetings. Members of the Congress and others interested in the session should arrange their vacation this year in September and attend the Congress gathering at that time. The combination will prove both enjoyable and profitable. The preliminary program will be published in the July issue of the ARCHIVES, copies can be had by a request mailed to the central office, 30 North Michigan Avenue, Chicago.

THE STUDENT'S LIBRARY

THE PATIENT AND THE WEATHER. By *William F. Petersen*, M.D. VOLUME I, *Part I*, The Footprint of Asclepius. Cloth. Pp. 127. Price $3.75. Ann Arbor, Michigan: Edward Bros., Inc., 1935.

To read this informative and fascinating contribution, is to go far in understanding a much neglected subject of the influence of environment on health, and to develop an appreciation of a writer as talented as he is erudite. It has been said that nothing is more commonplace than discussions of weather, its very propinquity in our daily life having made us especially oblivious of its particular rôle as a factor in health and disease. Stressed and taught by Hippocrates in simple, objective and logical illustrations, the relationship of the individual to his environment and its influence on racial characteristics, well-being and disease, has progressively been neglected and forgotten by succeeding generations, so that attempts to revive this important observation has met with stolid indifference and even hostile receptivity by modern medicine. It therefore required something more than historical perspective and respect for Hippocratean teaching to awaken renewed interest in this fundamental problem. The author has accomplished this task in so masterly a fashion that one's appreciation is divided between praise for his unusual erudition, commendation for his gentle but penetrating criticism of modern trends in medical education, and, yes, envy for his delightful rhetorical talents that have made it possible to transform an exposition of the driest background to one that virtually pulsates with interest in life. It is therefore a pleasant contemplation that the foregoing volume represents but the first of a planned series of monographs dealing with meteorologic influences affecting the normal and diseased human under American environmental conditions. The work presents an illuminating review of the spirit of Greek medicine; the teachings of the great schools of Cos and Cnidos and their influence on modern medicine. It points out the present trend of medicine towards overspecialization, and calls attention to the modern overemphasis of the search of the disease at the expense of the symptom. Under the author's analytical exposition the writings of Hippocrates become infused with new life and meaning — logical, impressive and eloquent. He demonstrates by scientific proof obtained through many clinical observations that the changing seasons and environment have a definite and impressive influence on health and disease.

It is regrettable that space forbids a more detailed discussion of the valuable features of the book, such as the relation of environment to racial differentiation with especial regard to bodily shortcomings and abnormalities, including certain endocrine, cardiovascular, constitutional and even infectious diseases, but for full appreciation these must be studied in the original. The title of this volume, *The Footprint of Asclepius*, is well chosen, because when the Greeks spoke his name they generally meant "god of the clear, bright, radiant air after a storm." We await the future publications on this subject with impatience, feeling sure that the succeeding volumes having the same parentage will be as interestingly informative as the one under consideration. We urge every physician and scientist, every medical and lay library to read or provide this book for those that eventually will seek its contents and become enthused over it.

PHYSICAL THERAPY FOR NURSES. By *Richard Kovács*, M.D., Clinical Professor and Director of Physical Therapy, Polyclinic Medical School and Hospital, New York, etc. Cloth. Pp. 286 with 78 illustrations. Price $2.75. Philadelphia: Lea & Febiger, 1936.

No one can appreciate the need of a concise text on physical therapy for nurses more than the physician who has sought and found wanting technical assistance for the routine care of his patients. The

hospitals, too, have recognized the inadequacy of the present nurses curricula and have endeavored to correct this weakness by special courses and instructions. Apparently the average medical text book on the subject contains certain technical and formal information of greatest value to the physician, and least to those whose aid is often as definite a requirement as is that provided by instruction and practice for other divisions in the medical art. The present work has provided such information for nurses who have ambitions to extend their education in physical therapy practice. It represents a well knit, informative and semi-technical exposition, full of authoritative discussions on the topics of special interest to nurses and physical therapy technicians. The author should be felicitated on the clarity of his discourse and on his efforts to stress the technics of each subject under consideration. This union has provided a clear and definite presentation of the essential facts of importance to those for whom this work is intended. In the space of nine large chapters and a syllabus, the author discusses the physical forces, classification of the forces utilized, methods, technics and dangers of physical therapy. At the end of each chapter is appended a series of questions related to the topic under discussion, questions both pertinent and practical. A special chapter written by McGuinness discusses in detail the importance and methods of therapeutic exercise. This is a book which has long been needed to place in the hands of trained nurses or physical therapy technicians to augment their clinical training and to imbue them with a keener sense of appreciation of the importance and responsibility of their vocation.

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1. INFLAMMATION. 2. CONTRIBUTIONS TO THE PHYSIOLOGY AND PATHOLOGY OF CIRCULATION. By Professor *August Bier*, Berlin. Translated by *Linn J. Boyd*, M.D., F.A.C.P. Cardboard. Pp. 98, 93. Printed privately by the Translator. New York City.

The English speaking medical profession owes a debt of gratitude to Dr. Boyd, who has not only prepared excellent translations of the two latest contributions by August Bier, but has had them printed at his own expense solely in the interest of medical science. The books unfortunately are not for sale, Dr. Boyd having remained content to distribute copies among medical libraries and other institutions of learning. Those who so desire must arrange to study the two interrelated problems treated by the author at one of the many medical libraries. August Bier needs no introduction to our readers, for there hardly is a physician or surgeon who has not at least some knowledge of the epochal contributions of the creator of hyperemia as a therapeutic agent. Whenever we subject infectious and inflammatory processes to thermotherapy, it is on the basis of Bier's physiologic concepts of different forms of hyperemia that we rationalize the therapeutic procedures. For more than forty years Bier has given the medical world the benefit of his experimental and clinical experiences, all of which have contributed to a trend of conservatism in the surgical management of many infectious and inflammatory processes. Since his retirement from the chair of surgery in the University of Berlin he has published extensive serials during the years 1933-1935 in *Virchow's Archiv* and in the *Archiv für klinische Chirurgie*, respectively, all of which have been made available in the English language as two large sized monographs. These, as their titles imply, are critical expositions of his earlier works on hyperemia and on the collateral circulation. Though from the one of some of the passages it may strike the reader that these contributions are the author's scientific testament, we can only express the hope that August Bier will continue to enrich medicine and surgery for many a year to come.

Limitation of space prevents a detailed discussion of the two monographs and we must content ourselves with pointing out that the first named one opens with a lengthy but exhaustive study of the history of inflammation. Going back to the time of Hippocrates, nay Heraclitus, Bier shows an erudition which historians of antiquity may well envy. But it is not history for history's sake that he wrote but as the fundamental groundwork for his own observations and reasonings. All theories that had been advanced before Bier's first publication and those advanced since then in opposition, are subjected to critical analysis and are refuted with the might of logic and physiologic laws. The apparently favorable results of antiphlogistic treatment are subjected to analysis and proof is established that they are due to hyperemia pure and simple (ice bag!). Finally he reviews his own work and results most critically, exposing pitfalls and cautioning against one-sidedness. The other and closely interrelated work on the collateral circulation is handled in a similar manner, except that it being the result of his own original research, the historic section is very short. Apart from the profound erudition of these works Bier stresses the clinical application of the theories. Theories *per se* are valueless to him unless they can serve suffering humanity. He does not hesitate to chastise researchers for their one-sidedness and insists that the man at the bedside must have the last and weightiest word. The future of medicine does not lie in the laboratory but in the clinic! "Only when we have the courage to ask the Why and For What Reason of inflammation and fever—will we—avoid the danger of running aground in the small angle of specialism." This his concluding remark in the monograph on Inflammation characterizes the *leitmotif* of the ideal of one of the greatest living surgeons.

THE 1935 YEAR BOOK OF RADIOLOGY. DIAGNOSIS. Edited by *Charles A. Waters*, M.D., Associate in Roentgenology, Johns Hopkins University; Assistant Visiting Roentgenologist, Johns Hopkins Hospital. Associate Editor, *Whitmer B. Firor*, M.D., Assistant in Roentgenology, Johns Hopkins Hospital. THERAPEUTICS. Edited by *Ira I. Kaplan*, B.Sc., M.D., Director, Division of Cancer, Department of Hospitals, City of New York, etc. Cloth. Pp. 580, Illustrated. Price $4.50. Chicago: The Year Book Publishers, Inc., 1935.

This volume maintains the excellent standard set

by the editors and publishers for the previous editions. It is noted that an associate editor now shares labors previously accomplished by Waters, labors sufficiently onerous to require able assistance Perusal of the contents discloses that the editors were faced with the usual difficulties to include not only such contributions that were pertinent and timely, but to exercise all their ingenuity to incorporate the great amount of diversified reports within the space allotted to them. Under the division of radiologic diagnosis, Waters and Firor call attention that "discovery of articles of unexpected interest, even those having to do with comparatively old subjects has renewed our confidence in human ingenuity," and enumerate a list of topics altogether too large and diversified to mention within the limitation of our space. Original roentgen studies have been, to mention a few examples, devoted to clarify the changes in nerves under pathologic conditions in relation to injury and tumor; diagnosis of inflammatory foci in bone tissue by means of small doses of thorotrast; bone-free radiography of the eye; localization of foreign bodies in the eye by aid of contrast substances introduced into Tenon's space; use of expiratory roentgenograms to reveal pneumothoraces; pelvimetry and cephalometry, and the like. Condemnation is expressed against the insidious regimentation of physicians and the growth of hospital practice in competition with physicians, a situation which has its perils in reducing the efficiency of scientific practice.

Dealing with the problems of radiotherapeutics, Kaplan sounds a pessimistic note on the problem of cancer and its increase in America. According to Hoffman, cancer "is most destructive when the stomach is involved; next, the uterus; then, the breast; and fourthly, the liver." In contrast, Kaplan reviews the situation of the small number of cancer victims among the Eskimos reported by Levine during the latter's personal investigations in the summer of 1934, and is unable to come to any definite conclusion. Perhaps this may be due to dietary habits, i.e., a régime based on the exclusive acid-forming foods eaten in that environment, or that these tribes are shortlived and hence do not enter into the carcogenic period. Since the most important objective of radiotherapeutics is its control of cancer, the present volume has analysed this problem at length, evaluating the super-powerful x-rays in comparison with the 220 Kv instruments, the efficiency of radium packs compared to the extra powerful radiation now obtainable. Kaplan further points out that the serologic diagnosis is still fraught with error, although the Gruskin test provides at least 75 per cent reliability. The distinct benefits resulting from pre-operative x-ray therapy is today well recognized, especially in malignancy of the breast. Adair feels that pre-operative radiation is the method of choice, while Crossen insists that in cancer of the cervix, surgery should supplement, not displace, the desirable method. One closes this volume with a pleasant impression that the present year book has included the most vital discussions, and has been critical, informative, and authoritative with reference to the latest literature on the subject.

LA DIATHERMIE EN OTO-RHINO-LARYNGOLOGIE. By Dr. *Joseph Lemoine,* Assistant in Otorhinolaryngology, Hospital Bretonneau. With a preface by Dr. *H. Bourgeois* of the Hospital Laennec. Carton. Pp. 391, second revised edition. Price, 65 francs Paris: Gaston Doin et Cie., 1935.

This monograph is actually two separate works, divided as such by the author. The first deals with electrophysics under the title *General Principles of Electricity.* It takes up 146 pages with 117 illustrations, the majority of which are wiring diagrams and photographs of high frequency apparatus manufactured in France. This part does not essentially differ from similar works, though it is noted that the author has a knack for illustrating electric currents by common mechanic phenomena, such for example as a freight train at rest and being pushed into motion. To judge from the many diagrams of electric circuits, the diathermy and short wave apparatus produced in France do not differ in principle from those made here, in England and in other countries. The second part entitled *Biologic Effects and Therapeutic Applications* embraces 213 pages (exclusive of references and the index) with 118 illustrations, mostly line sketches or photographs of instruments. In this part the author endeavors to describe the tissue effects of the high frequency current, the technic of medical diathermy and of the various methods of electrosurgery in two chapters of 74 pages. The clinical and last chapter (158 pages) seems to be especially devoted to the treatment of synechia, as if this condition were the principal indication for electrosurgical methods. So far as tonsillectomy is concerned the author properly opens the subject with the statement that diathermy is indicated only as an occasional procedure when classic surgery is contraindicated, but just the same a good part of the chapter is devoted to moot questions of coagulation or excision, leaving comparatively little space to the malignancies and other more important affections. The line drawings, too, are not rarely inadequate to depict procedures. This book should have appeared as two separate volumes. The second part conveys a good idea of the fact that French otolaryngologists are greatly interested in the use of the high frequency current, more so than is the case in the United States and in England.

THE NORMAL DIET AND HEALTHFUL LIVING. By *W. D. Sansum,* M.D., Chief of Staff of the Sansum Clinic and Director of Metabolic Research of the Santa Barbara Cottage Hospital, Santa Barbara, Calif. *R. A. Hare,* M.D., Member of the Staff of the Sansum Clinic, and *Ruth Bowden,* B.S., Dietitian of the Sansum Clinic. Cloth. Pp. 243. Price $2.00. New York: The Macmillan Co., 1936.

The flood of articles and monographs that has appeared on the dietetic management of disease is proof of a greater and deeper interest in this phase of general therapy on the part of the medical profession. The laity has become conscious of the importance of the proper selection of food during illness or for certain metabolic conditions. But from

the standpoint of the proper intake of food to maintain health, the literary contributions have been comparatively few in number. The present volume, though ostensibly prepared for the public, actually contains information many physicians will appreciate. Aimed at teaching both hygiene and the preservation of health, the authors have gone beyond the subject indicated by the title of the handy volume. Allergy, the development and care of the teeth, and some results of bacterial infection are discussed in three of the fourteen chapters. The arrangement of the text is a happy one, in that the authors describe the anatomic and physiologic fundamentals underlying nutrition. Foods that give energy are discussed according to their conventional grouping, which applies also to a chapter on foods that do not give energy. The vitamins, digestion and absorption, the elimination of wastes, and the intake of water have been treated in simple language and without burdening of technicalities. Indigestion, overweight and underweight, are discussed generally but in a manner to enable the reader to realize the importance of the involved problems. Menu planning, menu and weight tables conclude the text proper. A list of books and publications for collateral reading is appended. A well prepared index facilitates orientation of subjects treated in the text. This excellent little volume merits wide distribution among physicians, who will find in it hints as to the proper way of instructing their clientele in prophylactic nutrition.

(*Continued from page 366*)

Shortwave Interference Traced to Fever Machines

The cause of the mysterious shortwave radio "shadow" interference, which has greatly disturbed authorities in recent months, was definitely located by scientists in the Cruft Laboratory of Harvard University, under the direction of Prof. H. R. Mimno.

Medical devices for inducing artificial fevers were proved to be responsible for the radio interference. Tests conducted today from Cambridge with one of these machines in normal use proved that signals transmitted from one of the fever machines could be heard by the Naval Research Laboratory in Washington, D. C.

Previously it had been believed that machines of this type could interfere with radio reception over an area extending only a few miles from the source. Today's tests were the first to prove that a signal from an individual machine could be heard and identified hundreds or even thousands of miles, with sufficient signal strength to interfere seriously with shortwave radio.

The signal from one of these fever machines has the characteristic of any shortwave radio and gives a strong whirring sound, which prevents the hearing of any messages going out on the same wavelength. The power lines feeding the apparatus act as antenna in sending out interfering signals.

Reports indicate that interfering signals from these machines have been heard all over the United States, Canada, Central America, and even Europe.

Observers at the Cruft Laboratory looking for the source of the shortwave interference at the request of the Federal Communications Commission for the past ten days, have heard as many as twelve of these machines in operation at once, apparently in widely separated parts of the country.

Naval authorities have been seriously worried, because the hitherto unidentified signals have interfered with all types of shortwave communication, including airplane radio, official government communication, foreign broadcast, and ship-to-shore radio.

The investigators at the Cruft Laboratory point out that the interference difficulty can be easily overcome by minor changes in the design of the machines. Associated with Prof. Mimno in this research have been M. Selvidge, J. A. Pierce, and P. B. King, Jr. — *Science News Letter.*

Tendency to Rheumatism May Be Inherited, Physician Says

A tendency to arthritis, or rheumatism, to call it by its old-fashioned, popular name, may be inherited, Dr. Ralph Pemberton of Philadelphia, told the American College of Physicians. Success in preventing the disease depends on recognizing this fact. Infection and various other factors are the immediate causes of the disease, bringing on the pain and crippling in persons who have inherited or been born with the tendency to arthritis.

Success in treatment of the disease is highly gratifying, Dr. Pemberton said, and suggests unmistakably the possibility of controlling it. At present, arthritis, because of its disabling effects, surpasses tuberculosis as an economic and sociologic burden. When interest in the problem is great enough both among laymen and physicians, and when facilities for caring for arthritis patients in institutions become adequate, control of the disease will be possible, Dr. Pemberton predicted. — *Science News Letter.*

Sunlight Has Little Effect on Bacteria in Sea Water

Bacteria that live in the sea are relatively safe from the action of sunlight, it has been discovered by Drs. Claude E. Zobell and George F. McEwen of the Scripps Institution of Oceanography, the University of California. They report (*Biological Bulletin*, February), that in their laboratory experiments "sunlight has a feeble lethal effect on bacteria in the uppermost few millimeters of sea water, but even shallow layers of sea water are not sterilized by prolonged exposure."

"Virtually no bactericidal radiations penetrate sea water 3 meters," they continued, "and the intensity is materially reduced by passage through 10 centimeters of sea water." — *Science News Letter.*

INTERNATIONAL ABSTRACTS

A Biochemical Approach to Colitis. Max Trumper.

Med. Times and L. I. M. J. **63**:238 (Aug.) 1935

Colitis is a term that covers a multitude of ills. It forms a convenient catch-all for many bowel complaints which are not classified more exactly because there is little agreement as to their cause and cure. Many authors include among its common symptoms inflammed bowel, spastic or irritated colon, diarrhea — intermittent or continuous, sometimes alternating with constipation, excess of mucus, loss of blood — followed by anemia, emotional instability, visceral neurosis and general manifestations.

A fact not generally recognized is that water is absorbed from the intestines considerably faster than the rate of its excretion via the kidneys. Ordinary thirst is the natural consequence of water deprivation. It is induced partly by the dryness of the pharyngeal mucous membrane and also by the dryness about the nerve endings in the posterior part of the tongue. Frequently individuals suffering from protracted or intermittent diarrhea become accustomed to a dry mouth with an insufficient water intake because the bitter taste in the mouth obscures the feeling of dryness. Since water loss is associated with a loss of salts it is interesting to note that Mackie reports that in 75 cases of chronic ulcerative colitis 63 per cent showed evidence of deficiency states despite the fact that these patients had the advantage of a balanced diet. Thus one readily understands why these individuals fail to drink enough water to compensate for the loss from the large colon. Obviously there is need for mineral therapy of at least isotonic concentration so that both the water and salts may be retained.

On the subject of such therapy the author calls attention to the value of the water of Saratoga Springs in supplying the mineral salts in quantity and distribution well suited to normal body needs. In so-called colitis it is important to furnish the patient with a liberal supply of minerals and not to depend too much on diet. Too often the minerals originally present in vegetables are lost through draining off the water in which they are cooked. Vegetables should be cooked with a minimum of water and that carefully conserved and poured over them in serving. In addition to the above mentioned minerals these mineral waters contain the essential elements iron, calcium and iodine — the lack of each of which gives rise to a deficiency disease or specific pathology. Coesa water contains 12.6 grams of minerals to the liter while Geyser water (Saratoga Springs) contains almost 8 grams of minerals to the liter. The former is definitely hypertonic and the latter slightly hypotonic — by mixing various proportions the physician can in each case prescribe the concentration as well as the dosage. Individuals who drink Coesa water know that it does not relieve their thirst unless they subsequently drink plain water, whereas Geyser water not being hypertonic does satisfy one's thirst. The Rockefeller Institute reports: "The presence of iron salts in complex form of catalytic quality and apparently identical with the form in which iron salts exist in human blood, all the reactions of the well-known blood tests being given by Saratoga waters."

Short Wave Therapy.

Editorial Lancet **8**:436, (Feb. 22) 1936.

Since J. W. Schereschewsky published his first papers on short (wireless) wave therapy in 1926 the subject has become one of clinical and scientific interest, owing to the many reported discoveries and claims for effective treatment which have been made by research workers and clinicians. While the application of the new therapy requires technic as exacting as that of x-ray treatment, it is desirable for all of us to be aware of the principles on which it is based. Short wave therapy has come to mean treatment with electromagnetic oscillations of very high frequency, corresponding to a wavelength of 2 to 20 meters.

Now the human body consists of a number of tissues with different physical constants — fat, muscle, bone, blood and so on, and if the facts just mentioned are accepted it should be possible to heat one tissue differentially whatever its position in the body. This has been done in treatment of the kidneys within the intact body — it was found possible to coagulate kidney tissue without burning the skin — showing how potent a weapon has been put in our hands with which to influence deep-seated processes. Indeed, the importance of the new therapy lies in the possibility which it provides of introducing large quantities of thermal energy into the interior of the body without unduly heating the skin and the superficial fat. Much research has been done too on the influence of short waves on animals, bacteria, colloids, and other biological substances. One of the chief problems was to find out whether the effects produced were due exclusively to the production of heat, or whether there might be a specific effect which cannot be attributed to heat. Opinion is fairly divided on the point, but it seems that the behavior of bacteria and certain chemical effects can only with great difficulty be explained without presuming some form of specificity.

Important as these problems are, the practitioner is more anxious to be told what kind of disease can be successfully treated by short wave therapy and what advantages, if any, the treatment may have over other methods of applying heat. It may, we think, be taken for granted that the possibility

of direct heat formation in any deep-seated organ must have important consequences. The range of indications is widened by the inclusion of organs which could not be reached by diathermic treatment; chronic inflammation in bones, joints, tendons, sinuses, and internal organs, including the lung is known to have responded favorably to short wave therapy, and sometimes where every other treatment had failed. Striking results are claimed for sciatica and neuritis, and some diseases of the arteries, and whereas diathermic currents cannot be applied with impunity to acute inflammatory processes, short wave therapy scored its first successes in the treatment of boils, carbuncles, and cellulitis. Those who wish to pursue the subject further will find excellent and detailed information in several recently reviewed books.

Hard and Soft Nevi. Eugene F. Traub.

Arch. Pediat. **53**:197 (March) 1936.

Nevus Verrucosus may exist at birth or may develop in early childhood or even later. The lesions may be single or multiple, limited or extensive, and may be situated at any point on the integument. In most instances removal can best be achieved by electrodesiccation, and a novocaine anesthetic is usually required. In selected cases surgical removal gives excellent results. Refrigeration with CO_2 snow is of distinct value. Neither radium nor the x-rays exert enough selective action on these nevi to warrant the risk attending their use.

Verruca Mollis is a firm elevation varying from a few millimeters to a centimeter in size, rarely larger. If exposed to friction or irritation from repeated or unskillful treatment, it may become malignant, but ordinarily this type may be removed without hazard.

If the lesions are not troublesome they should be left alone. Arsenic has been given internally, but is practically valueless. The deep nerve tumors do not materially yield to radiation and the skin tumors not at all. Surgical removal may be followed by return at or near the original site, this being especially true of lesions in the subcutaneous and intramuscular regions of the arm, leg, popliteal space, neck or back. The small pedunculated lesions may, readily be removed surgically or by means of the electric needle.

A Good Dressing for Wounds Produced by Electrocoagulation. Lester Hollander.

Arch. Derm. and Syphil. **33**:730 (April) 1936.

The application of equal parts of Peru balsam and castor oil is very efficacious in dressing wounds produced by electrocoagulation therapy for warts, nevi, senile keratoses and epitheliomas. When extensive therapy has to be carried out, this dressing is especially valuable. The dressing is applied as follows: Saturate several layers of gauze with the mixture and apply them over the treated area; cover them with several layers of dry gauze, and keep the dressing in place with adhesive tape. Change it every second day.

Bathing. R. Cove-Smith.

The Practitioner **133**:164 (Aug.) 1934.

Bathing is a healthy and invigorating pastime for the robust when judiciously used. Even for invalids and those of poor physique it has great advantages if special precautions are observed. The time and duration of the baths are important. Dangers are present for those with poor circulation; but hypertonics may derive considerable benefit from short immersions in warm weather and from warm sea-baths. The relation of aural complications to bathing is discussed and warning given to those with colds, sore throats or septic trouble of the upper respiratory passages to refrain from bathing. Warmed sea-baths are compared with open air bathing.

Effect of the High Frequency Field on Some Physiological Preparations. Sir Leonard Hill.

Lancet **6**:311 (Feb. 8) 1936.

Since so-called ultrashort waves are being used extensively for medical treatment an explanation of their mode of action is required. Various authors have claimed that effects can be produced in the ultra high-frequency electric field which are not explicable on the basis of rise in temperature. As an additional proof of the fact that the action of the 3.4 meter wavelength is due to heat we have exposed the excised frog heart in the high frequency field, the heart being immersed in a small quartz vessel containing Ringer's solution. The temperature of the solution was taken at times with a thermometer, the vessel of course being removed from the field for the purpose. Strict accuracy is not claimed for this method, but as the heat loss from the quartz vessel and contents is slow no great error is introduced. It was found that the heart continued to beat normally until a temperature above 30 degrees C. was reached. The heart then ceased to beat but might be restored by cooling until a temperature above 35 degrees C. was reached, when the heart failed to recover. As the behavior of the frog's heart was exactly as it was known to be when merely submitted to increasing temperature in a bath of Ringer's solution, we conclude that the result of exposure to the high frequency field is wholly due to heat.

Results of Irradiating Staphylococcus Aureus Bacteriophage With Monochromatic Ultraviolet Light. Frederick L. Gates.

J. Exp. Med. **60**:179 (Aug. 1) 1934.

The incident energies required to kill staphylococcus aureus or to inactivate its homologous bacteriophage have been measured at the various wavelengths of the quartz mercury vapor arc between 238 and 302 millimicrons and found to run strictly parallel, the readings for the S. aureus phage being obtained at a uniformly higher energy level. This difference in levels is of less significance than the striking similarity in the shapes of the energy curves, which indicate that in both instances the same organic structures are absorbing the radiations. The results are open to three interpretations.

The most obvious is that the bacteriophage is a submicroscopic organism. Again, it is possible that the bacteriophage is a product of its own lytic action on the homologous bacterium and contains the essential structural units which in S. aureus also are destroyed by ultraviolet light and thus cause the death of the organism. A third, more remote explanation is that the phage, of wholly unknown nature, is absorbed on S. aureus material in so intimate a bond that the alteration of this material by irradiation renders the phage incapable of further lytic activity.

Tuberculosis of the Nasal Sinuses Treated by Irradiation. W. Annandale Troup.

Lancet **129**:667 (Sept. 21) 1935.

The forms of irradiation used in the treatment of sinusitis are: (1) infrared rays applied locally over the affected antra and sinuses; (2) ultraviolet rays, applied both postnasally and intranasally, by means of quartz applicators attached to the Kromayer mercury-vapor lamp; and (3) ultraviolet rays applied to the whole body by the titanium-alloy arc. The effects produced are dilatation of the ostia; establishment of drainage from infected antra and sinuses; increased flow of blood and lymph to the affected areas; increased bactericidal properties in the mucous secretion; regeneration of the mucous membrane and restoration of its normal function; and increase of bodily resisting powers. Success depends upon accurate dosage, since varying stimuli evoke varying responses in different cases.

The Effect of Radiation on the Excitability of Smooth Muscle. S. A. Guttman and D. T. Wilber.

Am. J. Physiol. **115**:194 (Mar. 1) 1936.

Although several papers have already been published on the effect of radiation of smooth muscle, up to date the only measure of the effects of the various treatments given was to note the change in the frequency and height of the rhythmical contractions. In the course of this investigation the stomach of the frog, *rana pipiens*, was employed after the animal was pithed. The method employed (stimulation by means of the thyratron chronaximeter) in obtaining the rheobase of stomach strips appears to be quite accurate for testing the excitability of smooth muscle. All strips from the frog's stomach are sensitive to radiation in the visible range as well as in the ultraviolet region employed. Ultraviolet radiation, if applied for the same time as visible radiation and other factors being equal (such as temperature, resistance of the tissue, normal excitability, intensity of irradiation, etc.) produced a greater increase in excitability than did irradiation from the visible end of the spectrum. After visible irradiation the strips soon returned to their normal excitability. After strong ultraviolet irradiation no such return to normal excitability was observed. The frog's stomach shows a broken strength-duration curve, indicating a low voltage, long time branch (alpha curve) for direct muscle stimulation and a high voltage, short time branch (gamma curve) for nerve excitation. Both ultraviolet and visible irradiation depressed the liminal voltage on the muscle branch of the curve, but showed no marked effect on the nerve branch of the strength-duration curve.

Diathermic Treatment of Retinal Detachments. M. J. Schoenberg.

Pennsylvania S. M. J. **37**:635 (May) 1934.

In the diathermic treatment of retinal detachment Schoenberg has the patient prepared as for any major operation on the eyeball. The eye is washed, the pupil is dilated and a fundus examination is made while the patient is on the operating table. Anesthesia is obtained by instillations of a 1 per cent solution of holocaine of butyn, a subconjunctival injection of a 2 per cent solution of procaine hydrochloride in the region to be operated on and, if the operative field is large, an orbital injection of 1 cc. of a 2 per cent solution of procaine hydrochloride is made. The conjunctiva is incised at a distance of about 10 to 12 mm. behind and parallel with the limbus. The conjunctiva and Tenon's capsule are carefully undermined, the episcleral tissue is removed and the sclera is exposed and freed of any loose tissue that may cover it. Any bleeding is stopped by applying an epinephrine-cocaine swab for a few minutes. If the bleeding originates from a large vessel, the application of the tip of a hot probe will stop it. Glass retractors are introduced in such a way as to keep the Tenon's capsule away from the eyeball. A hook underneath one of the recti or a forceps holding fast the episcleral tissue near the limbus is used to pull the eyeball in the proper position so as to make the area to be operated on accessible. The coagulating current is then applied using needles designed by Safar. The intensity used is just enough to coagulate through the sclera. The distance between the needle points is 2 mm. When the current reaches the choroid it produces a small area of coagulation. The distance between the applications should not be greater than 2 mm., and the applications should surround the torn area. If the tear is at the ora serrata, the applications should be made in a semicircle surrounding the part of the tear facing the optic disk, the extremities of this barrage ending at the ora serrata. These applications are to be made on the scleral surface of the eyeball. — [J. A. M. A (July 7) 1934.]

Transurethral Prostatic Resection with Report of 748 Cases. Theodore M. Davis.

Southern M. J. **28**:693 (Aug.) 1935.

After an experience of seven and one-half years in which resection has been employed in 748 individual cases, a frank consideration of prostatic resection will be of benefit. The medical profession should be continually impressed by the urologist that they should be alert to the possible presence of obstruction in all men patients beyond the age of 40; that they should elicit any symptoms of the condition, such as undue frequency, hesitancy, diminished force, micturia, and so on. They should in suspicious cases determine the presence or ab-

sence of residual urine. All doubtful cases should have a complete cysto-urethroscopic examination. The greatest benefit from this operation will come when every obstructive lesion is recognized early and corrected before obstruction has advanced to the stages ordinarily observed; when this is accomplished there will be no question as to the method of choice in dealing with the obstructive lesions.

There has been considerable discussion as to which types of obstructive lesion should be resected and which should be subjected to open operation. Any type of gland is amenable to resection, provided the operator has the skill and the perseverance to continue until a satisfactory operation has been consummated. It is generally conceded that the bars, the contractures, and small median and lateral lobes causing obstruction are suitable for this operation. When the operator has acquired sufficient skill the larger lateral lobes can be adequately removed. Two sittings may be required for resecting very large lateral lobes, although the author prefers to complete each case at one seance. He repeatedly removed from 50 to 75 grams of tissue within one and a half hour's time. Davis does not consider an operation of this duration more exhausting upon the patient than two briefer operations. In the two-stage operation there is less hemorrhage during the second stage and as the lobes have a tendency to collapse toward the midline, removal of tissue is expedited and with many operators this type of operation is preferable.

Temperature Changes in the Conjunctiva in Relation to Application of Heat and Cold to the Skin. G. Howard Gowen.

Am. J. Ophthal. **3**:331 (April) 1935.

For the temperature readings of the conjunctiva, a Queen potentiometer was employed. Three thermocouples were used. Each thermocouple was composed of two wires, one of copper and the other of German silver. The ends of the thermocouples were coated with shellac and embedded in celloidin. Five dogs were used for experimentation: three served for three experiments each, and two for two experiments each (a total of thirteen experiments). The dogs were placed under nembutol anesthesia.

Chilling of the skin results in a reflex lowering of the temperature of the conjunctiva. This response is markedly exaggerated after repeated applications of cold. Chilling of the skin with the associated lowering of the temperature of the conjunctiva should predispose to conjunctivitis. The conjunctiva responds to chilling of the skin in the same manner as does the upper respiratory tract. The similarity of the reflex response of the conjunctiva and of the mucous membrane of the nose to chilling of the skin may explain the simultaneous involvement of conjunctiva and nose in acute coryza.

Treatment With the Cold Quartz Lamp in Dermatology. G. S. Wright.

Arch. Derm. and Syphil. **31**:374 (March) 1935.

Wright has treated 180 cases of various skin diseases with this lamp; 94 of these were acne vulgaris, in which good results were obtained. Most of these patients had been previously treated with roentgen irradiation or were given roentgen irradiation conjointly. In the cases treated with the quartz lamp alone, a larger number of treatments were required. In most cases, the patients were freed from lesions and the degree of scarring was lessened. Other skin conditions that responded well to the cold-quartz lamp treatment are: Acne rosacea, various types of alopecia, eczema of the dry, squamous, and thickened type (not vesicular eczema), and a few cases of psoriasis and molluscum contagiosum. The rays of the cold quartz lamp causes erythema and desquamation, even with small doses, but no appreciable pigmentation of the skin. — [Abst. Penna. M. J. **39**:42 (Oct.) 1935.]

The Electrocardiogram In Fever. Harry Vesell and Wiliam Bierman.

Am. J. Med. Sc. **191**:484 (April) 1936.

With the inauguration of fever, the heart rate increased rapidly. In a previous series of 500 cases it averaged 8.5 beats per minute for each degree Fahrenheit elevation. Observations were made on changes in electrocardiograms produced by fever of between 104 to 106.5 degrees F., of three to five hours' duration, induced by physical means.

The alterations of electrocardiographic waves were not uniform. P and T waves were almost as frequently increased in size as decreased. The R wave, however, most often became smaller and the P-R and Q-R-S intervals in most instances were shortened. The RT level was usually depressed, never elevated. Of special significance was the transformation of several normal amplitudes or intervals to abnormal ones, as well as the reverse. This involved particularly the R and T amplitudes. Worthy of mention is the development of a prominent Q_3 in one instance. The mechanism of electrocardiographic changes is probably through reflexes, tachycardia, local cardiac and general chemical and physiologic alterations. None of the endocardiographic changes were permanent. No inference could be made that the fever produced any harmful effects upon the heart.

TEMPERATURE OF SKIN SURFACE *

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Although one hundred years have elapsed since Becquerel and Breschet[1] showed how the temperature of the surface of the human skin might be measured by thermoelectric methods, it is only during comparatively recent years that investigators have come to appreciate the great value of such determinations. When it becomes more generally recognized that a great mass of information of diagnostic and of therapeutic value may be obtained from this relatively simple procedure, we may anticipate that observations of the skin surface temperature will be made much more extensively. In this paper I am attempting to review the work that has been done thus far in this field in the hope that it will stimulate others to carry on similar observations in numerous fields, which hitherto have not been investigated.

Variations in Different Regions of the Skin

The temperature of the surface of the skin varies with the environmental temperature, with the temperature of the body, and with conditions in the skin and in the structures lying beneath it.

In a comfortable environment, the temperature of the skin surface varies in different regions of the body. The temperature of the skin surface of the trunk usually varies between 33.5 and 36.9 degrees C.[2] In a person sitting in customary clothing in a room, the air temperature of which is 20 degrees C., the average skin surface temperature is 34-34.8 degrees C.[3] In this connection, it is interesting to note that Liebermeister[4] stated that the temperature of the thermically neutral bath lies between 34 and 35 degrees C. According to Cobet,[5] these figures are found in persons of middle age with well-developed muscles and a moderate amount of subcutaneous fat. Individuals differ according to their constitution and activity.

The skin surface temperature is comparatively high in the neighborhood of large superficial arteries. Thus the region traversed by the temporal artery and the skin above the external maxillary arteries is warmer than the neighboring areas. In the palm of the hand the temperature is often several degrees higher than on its dorsum.[5] The skin surface temperature is lower over superficial veins than it is over superficial arteries. It is lower over protruding and markedly curved parts, such as the nose, ears, fingers, and toes.[6] The temperature of the skin is higher over muscles than over bone or tendons, over an active organ than over one at rest.[7] As a rule, stout persons (because of their thicker layer of subcutaneous fat) have a much lower skin temperature than thin ones.[5] The symmetrical areas are kept at about the same temperature. Usually these areas differ within 0.5 and 1 degree C.[5, 8] We have observed even greater temperature differences of the skin surface of symmetrical regions of the body. This would indicate that these areas may vary somewhat in their physiologic activity as well as in their configuration.

In general, the temperature of the skin covering the extremities is lower than that of the skin covering the head and torso. The skin surface temperature of the extremities also shows the greatest fluctuations when the body is exposed

* This monograph will be published through two consecutive issues. — EDITOR.

to changing environmental temperatures. When there is the possibility that the body temperature may rise because of an increase in metabolism or because of the high temperature of the surrounding medium, the skin surface temperature of the extremities increases so that it may approach or actually reach the same temperature level which exists over the head and torso. On exposure to cold the skin surface temperature of the extremities becomes much lower than that of the rest of the body. We have observed the skin surface temperature of the toe to go as low as 15 degrees C. on exposure to cold and as high as 45 degrees C. on exposure to heat.

While the temperature of the exterior of the body fluctuates widely, that of its interior varies between narrow limits. Indeed, it would appear as if the purpose of the marked variations in skin surface temperature is to keep the temperature of the interior relatively constant.

The maintenance of the temperature of the interior of the body within a relatively small range seems to be necessary for the best conduct of its physiologic processes under normal conditions. The body maintains its even temperature, in spite of great variations in its internal metabolism and in the temperature of its environment, by means of the sympathico-adrenal mechanism[9] and the heat regulating centers in the diencephalon.[10]

There is a constant balancing between heat production and heat loss. Heat loss occurs through convection, conduction, radiation, and evaporation. According to several workers,[11, 12] about 76 per cent of the body heat is dissipated by radiation, conduction and convection of the skin and about 24 per cent by the vaporization of water from the skin and lungs. In hot weather or with increased heat production, the amount lost by the vaporization of water rapidly increases so that it may account for 100 per cent of the total heat dispersion.[13]

It would appear as if the skin of the extremities acts as a sluice gate for the heat reservoir of the body, through which the heat is lost when the body desires to prevent an increase in its own temperature and by means of which heat is conserved when the possibility of a lowering of the body temperature occurs. The greatest fluctuations are observed in the skin surface temperatures of the toes.[14, 15] Several experiments lend weight to this point of view. Warming certain portions of the brain[16] or the blood going to the brain[17] or warming of the whole body[18] is followed uniformly by peripheral vasodilatation.

Influence of Age

Age is said to have an influence on skin temperatures. With old age, the temperature becomes lower. Basal metabolism diminishes with increasing years.[19, 20] In children, Kunkel[7] and Talbot[21] state that the skin surface temperatures are lower than in the adult, while Cobet[5] describes higher temperatures. The heat regulating apparatus is not fully developed at birth, and is almost completely absent in the premature infant.[14] The temperature of the skin of the premature infant, as well as that of the body, is affected by the surrounding temperature, and to a greater degree than it is in the normal infant. Among the factors that favor lowering of the body temperature in the premature infant are the relatively greater area of heat eliminating surface, i. e., the skin as compared with body weight; the normal lack of subcutaneous fat which prevents escape of heat from the more vital tissues of the body; the normally low production of heat by the organism itself, and the failure to increase this production by shivering, crying and other forms of exercise. The sweat glands do not function as efficiently as they do in the fully developed newborn infant. All the newer scientific observations justify the long exercised clinical precautions directed toward the careful maintenance of the body temperature of the newborn and of the prematurely born infant.[22]

Effect of Changes in Metabolism

The close connection between the temperature of the extremities and the heat dissipating mechanism is shown by the fact that under constant environmental conditions a simple linear relationship is found between the temperature of the great toes and the basal heat production per unit of surface area.[23] Ipsen[24] calls attention to the relationship between the rise in basal metabolic rate and the skin surface temperature. He describes one case of myxedema where he found a surprising parallelism between disease of the thyroid and the skin surface temperature of the foot.

There is a diurnal variation in the skin surface temperature of the feet. The temperature of these parts rises each night just before the onset of sleep.[25] The rise in the surface temperature of the extremities occurs at or just before the time when the rectal temperature begins to decline during the evening. The maximum surface temperature is maintained while the rectal temperature is at its minimum. As the rectal temperature rises during the early morning hours, that of the skin of the extremities falls.[26] The relation of rise of temperature of the extremities to the onset of drowsiness or sleep is interesting, because it is associated in the change of state of many other bodily functions. Rectal temperature decreases, heat production falls off, and there is a decrease in the tone of the skeletal muscles.[27]

Muscular exercise influences the temperature of the skin. During the first few minutes of exercise the temperature of the skin falls and later rises. As an explanation, it is suggested that when exercise is commenced, heat is retained in the body in order to increase the function of the muscles. According to Burton,[28] during exercise there is an initial tendency for the skin temperature to rise. This rise may be obscured by the cooling effects of the wind caused by the motion. The rise is quickly halted and followed by a fall of temperature starting quite definitely at a sharp point, which corresponds to the subjective sensation of sweating. The evidence suggests that this fall is due to the cooling by evaporation of sweat rather than to the shift of blood flow suggested by Benedict and Parmenter.[11]

Psychic factors may influence the temperature of the surface of the skin. In cases of hyperemia of the face due to excitement, there occurs a rise in the skin surface temperature over the cheeks.[29]

Cohn and Steele[30] noted the occurrence of fever in a case of heart failure where no pathologic changes other than cardiac was present to account for the temperature elevation. A possible explanation which they offer is that the elevation of the temperature of the interior of the body is due to a slowing of the blood flow to the surface as well as to other parts. They point out, however, that the accumulation of heat may not be simply explained by the body's failure to lose heat due to the insufficient cutaneous flow. The so-called heat center may be incapacitated by the poor circulation through it. Due to anoxemia a toxic substance may be formed in the tissues producing the fever. Such substances have been described.[31, 32]

Variations During Fever

In fever the skin surface temperature gradient which normally obtains, disappears so that the temperatures of the various parts of the skin surface of the body reach a more or less common level. This level is a lower one than that of the internal temperature when fever is produced by physical means through the application of heating energies. The skin surface temperature gradient disappears even before the internal temperature (as judged by the rectal thermometer) begins to rise. As the body temperature becomes more elevated the skin surface temperature rises and at high temperatures such as, for example,

around 106 degrees F. (41.1 degrees C.), the temperature gradient may become reversed, i. e., the temperature of the skin surface of the toes may go higher than the temperature of the skin surface of the torso (fig. 1.).

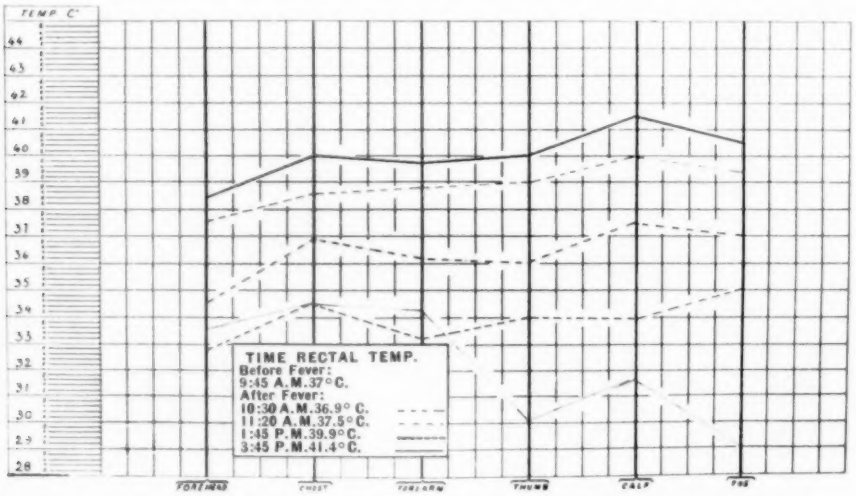

Fig. 1. — Skin surface temperature in fever following use of diathermy and photothermy; gonorrheal salpingitis; female, 28 years old.

When the body supplies its own energy to create a fever (as after the intravenous injection of typhoid vaccine) the skin surface temperatures, particularly that of the toes, may remain as they were originally or they may even go lower, while the internal temperature is being elevated. This is the period in which the subjective sensation of a chill occurs. After the systemic temperature elevation has become established, the skin surface temperature rises. During defervescence the skin surface temperature of the toes may remain comparatively high so as to encourage the loss of heat to the environment (fig. 2.). If the ob-

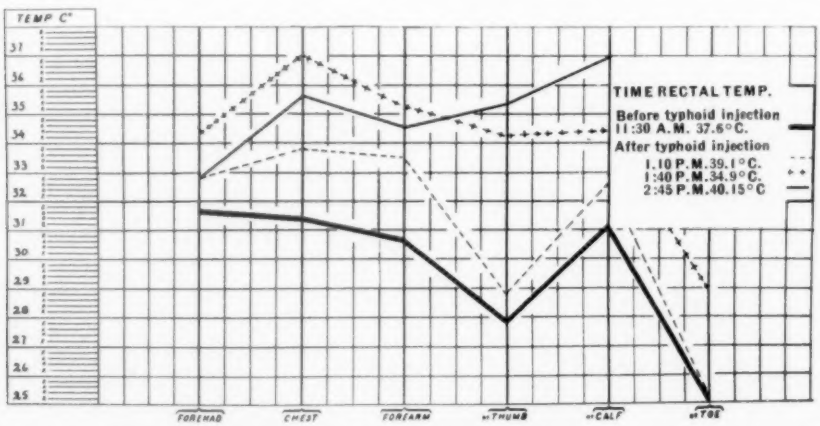

Fig. 2. — Skin surface temperature in fever following typhoid vaccine intravenously; chronic atrophic arthritis; female, 54 years old.

jective of a therapeutic fever be to increase the blood flow in a case of insufficient peripheral circulation, it would seem more rational to produce the fever by physical means, inasmuch as the initial stage of vasoconstriction is avoided. The induction of fever to increase peripheral circulation presupposes that the possibility of vasodilatation exists. Where occlusive vascular disease is present,

an elevation of the systemic temperature may be of no value or may even do harm. In a case of saddle thrombus of the common iliac arteries it was observed that the skin surface temperature gradient still persisted in spite of an elevation of systemic temperature (fig. 3.). This was, of course, due to the

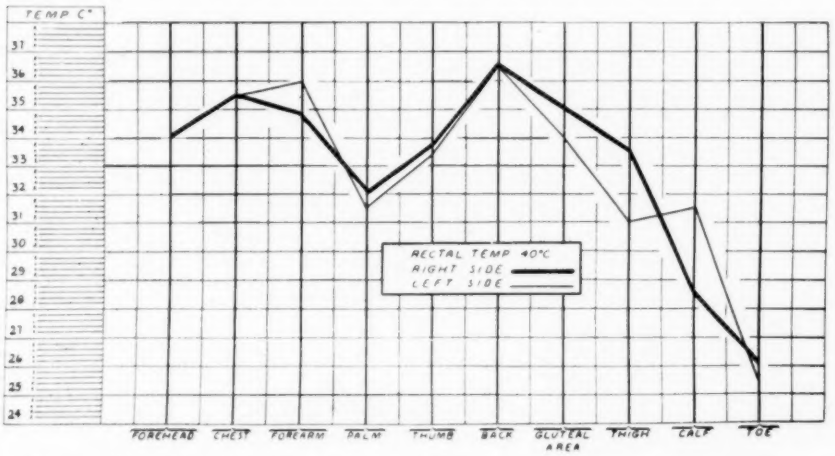

Fig. 3. — Effect of saddle thrombus at bifurcation of common iliacs; female, 55 years; auricular fibrillation.

fact that the blood could not pass through the occluded arteries. It is actually possible to diagnose and in some measure to indicate the extent of vascular occlusion by the changes of skin surface temperature.

According to Ipsen, if gangrene exists, amputation should be done only in an area the skin temperature of which is less than 1 degree C. lower than that of the other side.[33]

Variations in Heat Tolerance in Various Parts of the Body Surface

There is a marked difference in the heat tolerance of various parts of the surface of the body. The extremities which are normally more responsive to changes in systemic temperature also appear to possess greater sensitivity toward increase in their normal temperature, i. e., they have the lowest tolerance temperatures. With approximately the same incident of heating intensity, various parts of the body surface increase in temperature at varying rates so that the maximum tolerated temperature is attained at different time intervals in diverse parts. In general those portions of the body surface which have the lowest tolerance temperatures are also characterized by their ability to endure heating for the longest periods of time. In fact, the tolerance time and the tolerance temperature rise are approximately in inverse ratio. The ability of the skin of the forehead, of the feet, and of the hands to tolerate heat better than other parts of the body's skin surface and yet maintain lower temperatures may possibly be explained by increased sweating of these parts, by the presence of arteriovenous anastomoses, and by the greater number of thermal nerve endings. Bazett and his coworkers[34] have investigated the depth and distribution of the end organism concerned in the sensation of temperature in the prepuce. They found that the spots sensitive to warmth were few in number (one or rather less per sq. cm.). They existed at a depth of about 0.3 mm. These histologic studies demonstrated that the Ruffini end organs have a distribution agreeing fairly well with that of the warm spots. The spots sensitive to cold in this area varied in number from six to twelve per sq. cm. They existed at a depth of about 0.1 mm. This

distribution corresponded to that of the end bulbs of the Krause type as suggested by histologic studies.

According to Grant,[35] the presence of arteriovenous anastomoses was first demonstrated by histologic methods by Hoyer[36] (in 1877), who described them as occurring in the terminal phalanges, the ears, the nose, and the tip of tail. Hoyer suggested that since the anastomoses seemed to be confined to projecting parts of the body, their function may be to maintain the temperature of these parts when exposed to cold. Grant's observations led him to believe that the arteriovenous anastomoses form an important factor in the mechanism for regulating body temperature. They are by-passes which can be thrown in and out of action to permit enormous variations in blood flow, while the capillary circulation required for the local needs of the tissues, under a control largely independent, is safeguarded against either surplus or deficient blood supply. Thus the ear temperature can be raised very considerably before the anastomoses dilate. Over a range of from 18 to 35 or even 40 degrees C., they remain constricted independently of dilatation of the other vessels. Usually the temperature has to reach 40 degrees C. and over before an anastomosis shows any material relaxation, although its artery of origin is well opened at 35 degrees C. When the temperature is reduced below 15 degrees C. the anastomoses open up, although the other vessels are at first constricted.

Effect of Cold

The influence of the application of cold has been studied.[37] In a comfortable environment the temperature of the skin of the middle finger is about 30 degrees C. (the temperature of the air varying from 18 to 19.5 degrees C.). If after the application of cold, the temperature of the skin of the finger falls to 20 degrees C., the subject experiences a feeling of chilliness and of slight pain. Below 20 degrees C. these uncomfortable sensations become more marked. Shivering begins when the skin attains a temperature of approximately 19 degrees C.[38] When cold is applied to a local area the skin surface temperature in that area falls quickly. On the application of an ice bag, for example, the skin temperature may be diminished 20 degrees C. within one-quarter of an hour, and may reach a minimal 5-6 degrees C. in forty to sixty minutes. By conduction the effect may extend to the underlying tissues.[5] On immersion of the body in cold baths, the internal temperature may at first rise a few tenths of a degree.[4] The subsequent course of the temperature varies with the constitution of the individual, the thickness of the subcutaneous fat layer, and the length of time of immersion.

Skin Surface Temperature as a Diagnostic Determination of Vascular Status

The ability of the skin surface temperature of the extremities to fluctuate widely permits us to evaluate the vascular status of these parts. If one forearm is immersed in water at 110 degrees F. (43.3 degrees C.), it is possible to observe a rise in the skin surface temperature of the toes in a normal subject. The rise in toe temperature occurs after an interval of several minutes, the height of the rise becoming established in about twelve to fifteen minutes.[39] We have observed that in the normal subject the temperature of the skin of the great toe rises to approximately the same level as the skin surface temperature of the forehead (fig. 4.).

We consider it important to observe the skin surface temperature of the forehead. In a given individual it furnishes us with a criterion of skin surface temperature against which temperature of the skin surface of other parts of the body (particularly the toes) may be compared. The temperature of the skin surface of the forehead fluctuates comparatively little with varying environmental conditions. The local blood supply of the forehead plays an unimportant

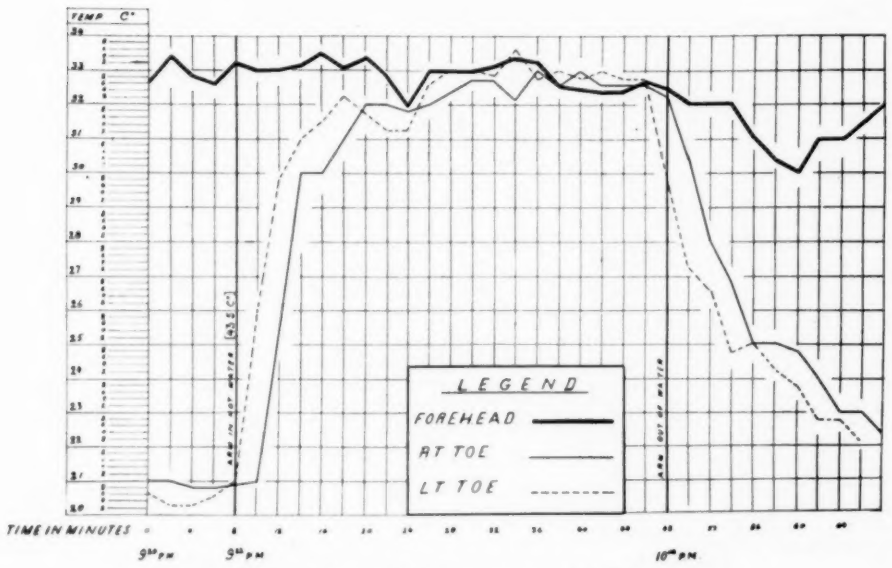

Fig. 4. — Effect of forearm in hot water; normal female, 21 years.

rôle compared with the conductive heat from the head.[5] It may possibly be that the relative thermal stability of the forehead temperature is part of a protective mechanism preventing thermal variations in the brain.

The question arises as to the mechanism of toe temperature rise in the normal subject when heat is applied to some distant part of the body, such as the forearm. By observing the rectal temperature in the interval preceding the elevation of toe temperature, we note that the rectal temperature gradually becomes elevated even before the temperature rise can be demonstrated in the skin of the toes. When the temperature of the tissues of the body is changed by an amount varying from 0.01 to 0.04 degrees C., the central mechanism responds in two to four minutes.[40] The resultant alteration in cutaneous vasomotor tone antagonizes the body temperature to change. It appears, then, that the rise in the skin surface temperature of the toe is due to the activity of the thermoregulatory mechanism in its effort to resist the elevation of body temperature, which would occur if the body did not utilize its ability to increase heat dissipation by augmenting the vascular flow to the extremities.

If this flow is interfered with as e. g., by causing a constriction of the normal leg with a cuff inflated to the equivalent of 60 mm. pressure, no rise or a much restricted one occurs in the temperature of the toes (fig. 5). The inability of the toe temperature to rise under these circumstances also occurs where the circulation has been restricted by some pathologic condition such as, for example, arteriosclerosis (fig. 6), thromboangiitis obliterans (fig. 7), or embolism.

In a case of varicose veins with phlebitis, particularly marked in one leg (left), it was of interest to observe the skin surface temperature of the lower extremities when the forearm was placed in hot water. When these observations were made with the patient lying in bed, no gross variations from the normal occurred in the skin surface temperature responses of the toes. When, however, similar observations were made with the patient standing, the skin surface temperature of the great toe of the involved leg rose much more slowly and to a level much below that of the other comparatively normal extremity (fig. 8). From this it would appear that in the presence of varicose veins, in spite of the incompetence of their valves, the circulation of the lower extremities may be

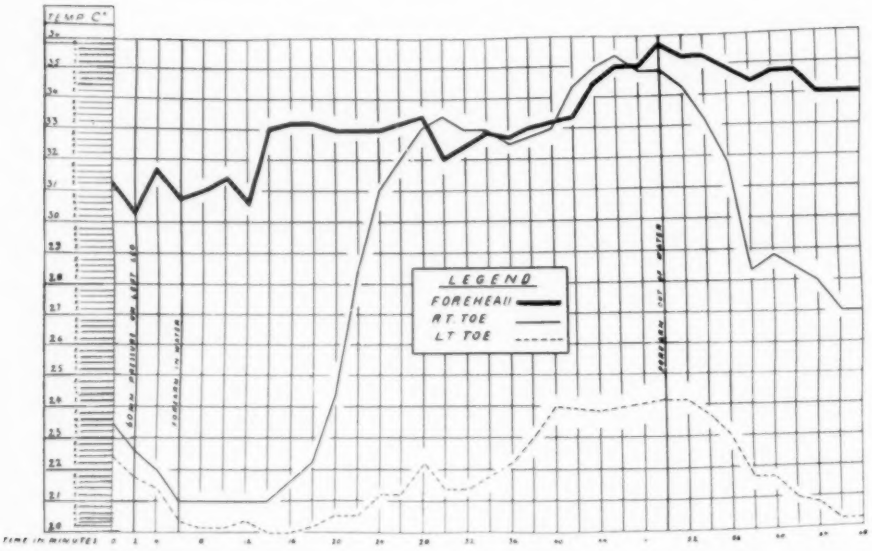

Fig. 5. — Effect of forearm in hot water (43.5 degrees C.); left leg constricted with 60 mm. Hg. pressure in cuff; normal female, 21 years

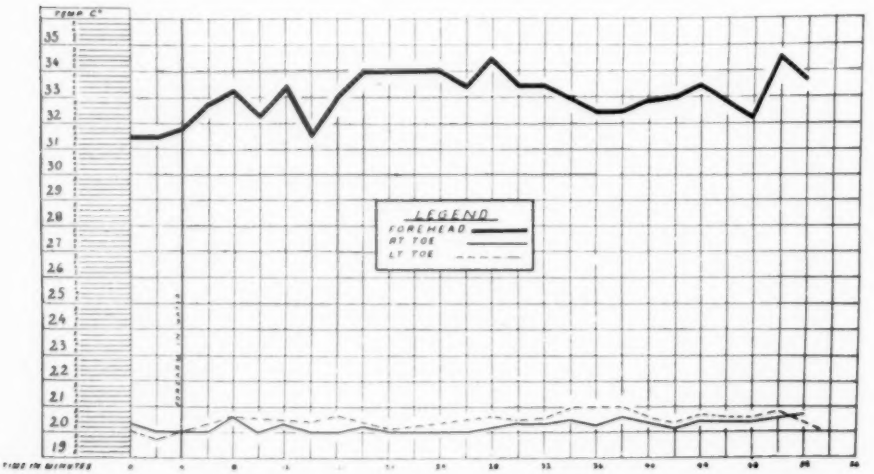

Fig. 6. — Reaction to forearm in hot water (43.5 degrees C.); arteriosclerosis; male, 62 years.

adequate when the patient is lying down. In the standing position, however, the weight of the column or columns of blood in the incompetent veins exerts a back pressure upon the capillary circulation, so that it becomes relatively inadequate. This fact explains the improved status of the sufferer from varicose veins when the veins are occluded by surgical means or by the action of some sclerosing solution.

If the forearm be immersed in very cold water, it will be observed that the temperature of the skin surface of the toe becomes lower (fig. 9). Under these conditions the body is evidently endeavoring to maintain its temperature level by shutting down on heat loss. In the presence of sufficiently severe vascular disturbances, such as arteriosclerosis (fig. 10) and thromboangiitis obliterans, the skin surface temperature of the toe does not go lower in response to the application of cold applied to the forearm.

The use of a thermostatically controlled heating hood permits us to observe

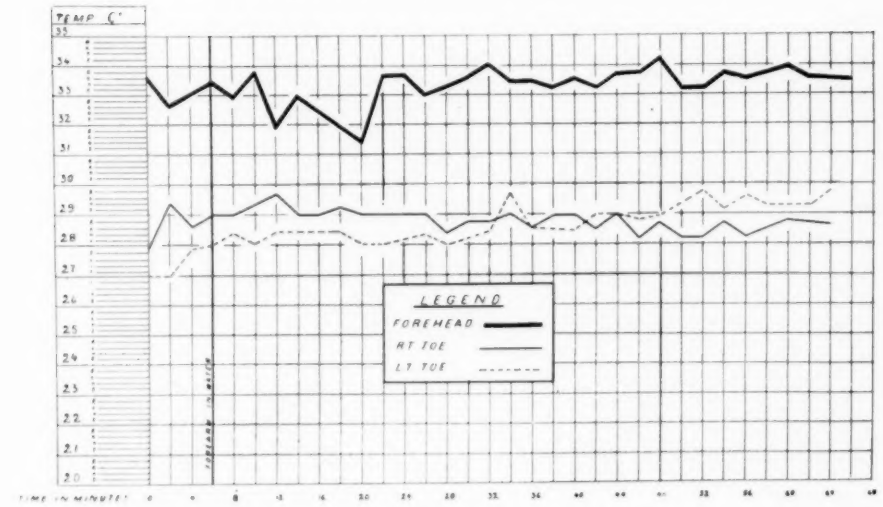

Fig. 7. — Reaction to forearm in hot water (43.5 degrees C.); theromboangiitis obliterans; male, 34 years.

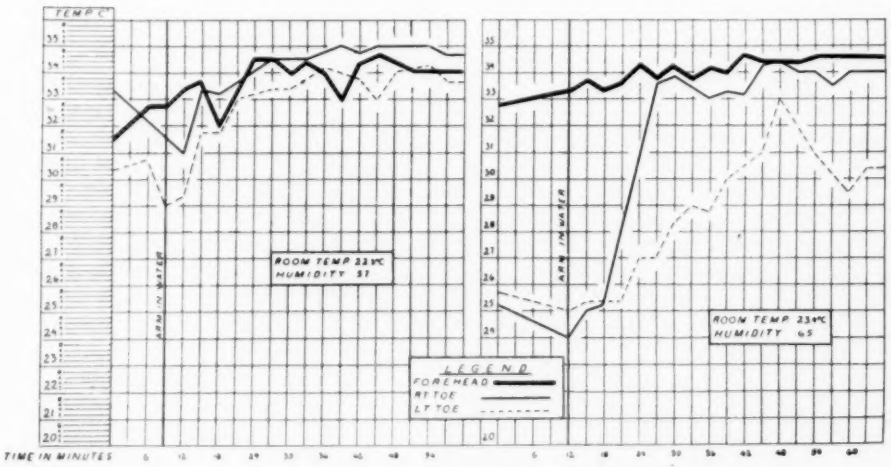

Fig. 8. — Varicose veins; effect of forearm in hot water (43.5 degrees C.); marked involvement of left leg; female, 46 years.

the reaction of the skin surface temperature of the toes when the hood is placed over the lower extremities. The thermal responses to the application of direct heat may be more complicated than when the heat is applied at a distance. The factors of heat capacity and the ability to dissipate the heat by means of the blood stream are important ones.

On applying air heated to about 100 degrees F. (37.8 degrees C.) by means of this thermostatic hood, we observe that the skin surface temperature of the toe rises to about the same level as the skin surface temperature of the forehead. When the normal leg is constricted by means of a cuff inflated with air to a pressure of 60 mm. of mercury so as to embarrass the venous return, the toe temperature rises more slowly and does not reach as high a level as in the unconstricted leg (fig. 11). In cases of varicose veins and phlebitis, the skin surface temperature response to direct heating is lower than in the normal. In cases of arteriosclerosis, on the other hand, the skin surface temperature of the toe frequently rises above that of the forehead. In thromboangiitis obliterans,

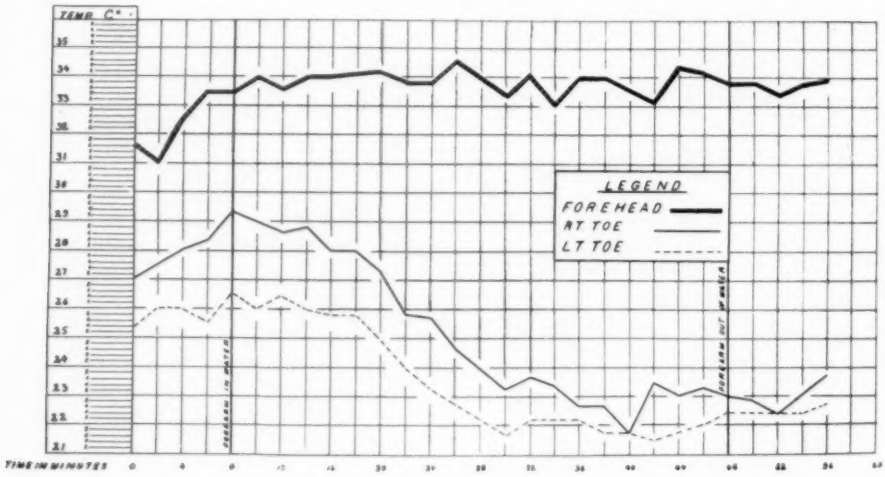

Fig. 9. — Reaction to forearm in cold water (10 degrees C.); normal female, 28 years.

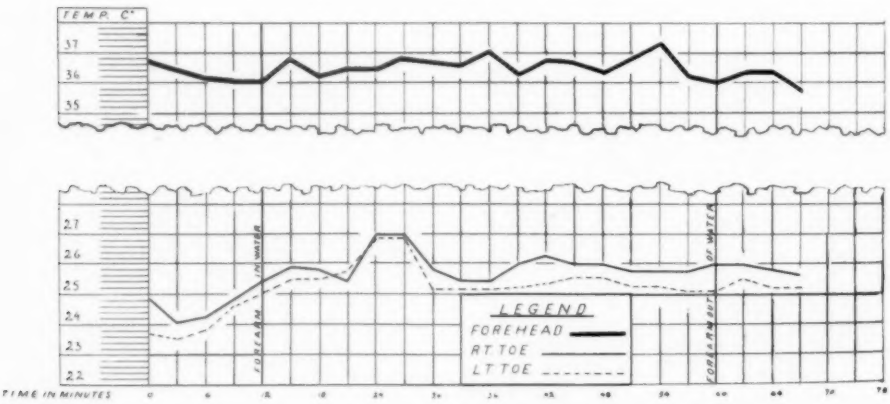

Fig. 10. — Reaction to forearm in cold water (15 degrees C.); diabetic arteriosclerosis; male, 65 years.

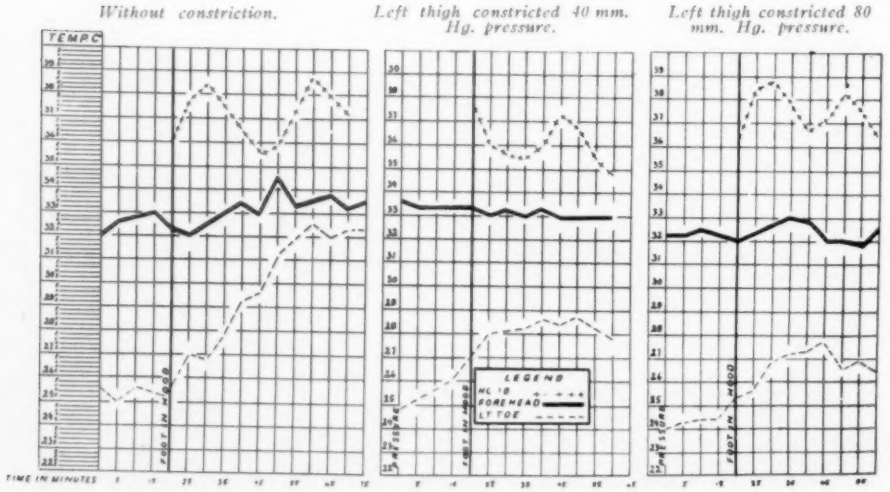

Fig. 11. — Reaction to direct heat; thermostatically controlled hood; normal female, 24 years.

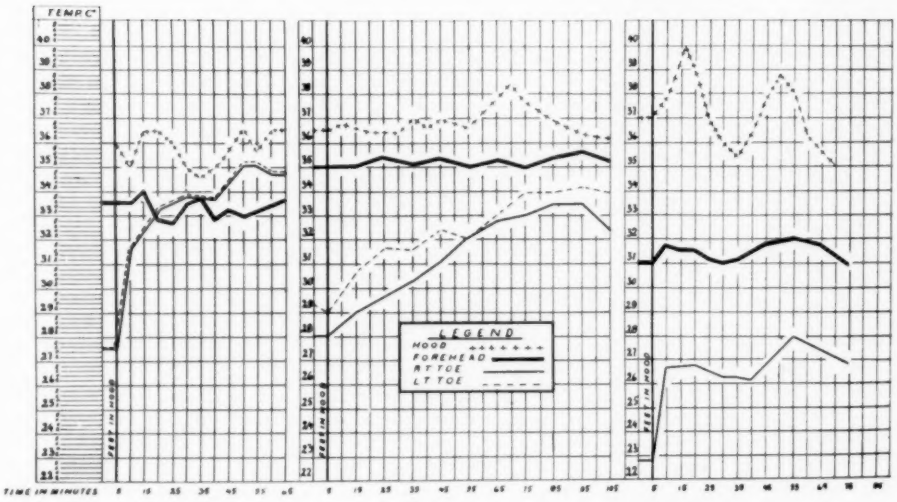

Fig. 12. — Reaction to direct heat; thermostatically controlled hood.

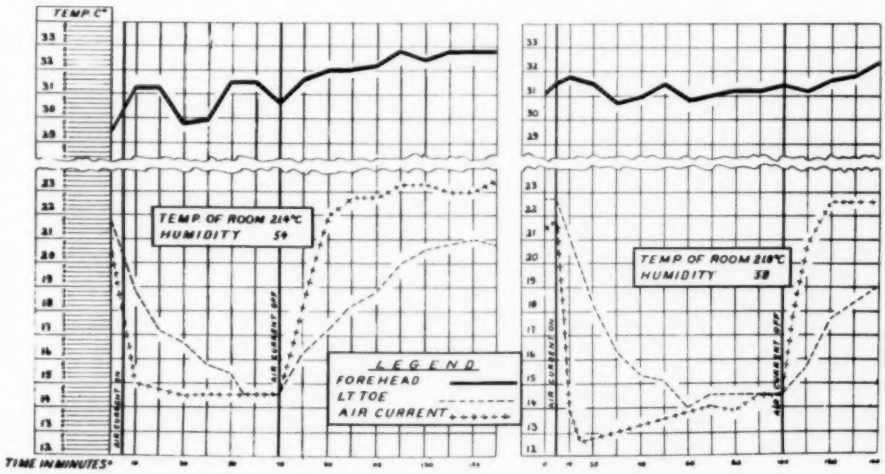

Fig. 13. — Reaction to cold air; normal male, 26 years.

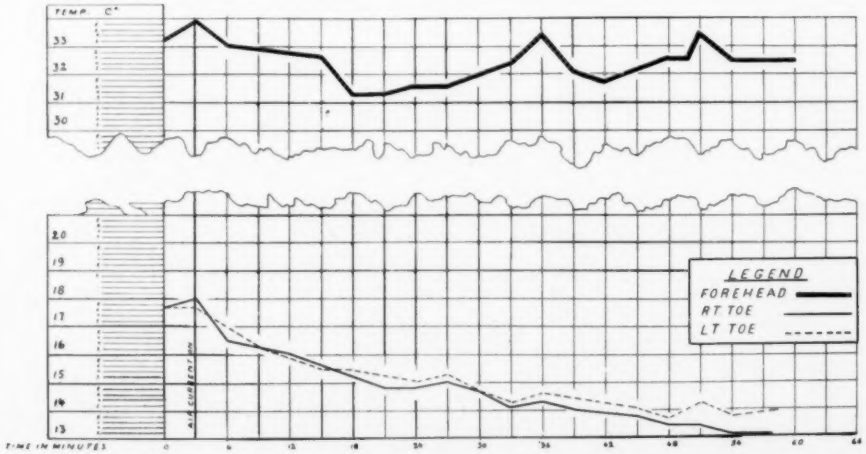

Fig. 14. — Reaction to cold air; air at 15.5 degrees C., blown over lower extremities; diabetic arteriosclerosis; male, 64 years.

because the pathological processes involve both veins and arteries, the toe temperature response may resemble that of the normal. Where the affection primarily involves the veins (as in varicosities) or the arteries (as in arteriosclerosis), it is possible to make the diagnostic differentiation by observing the changes in the temperature of the skin surface of the toe when the leg is exposed to heat directly (fig. 12).

Application of heat to the skin does not always produce vasodilatation reflexly, but may result in vasoconstriction if the stimulus is excessive.[40]

The direct application of cool air to the lower extremities rapidly causes a drop in the skin surface temperature of the toes (fig. 13). This response is delayed and diminished in the presence of vascular disease, such as arteriosclerosis (fig. 14) and thromboangiitis obliterans. The vasoconstriction arising from the prolonged application of cold to the skin is due in part to the action of a central mechanism excited by cooled blood returning from the skin. The application of cold to the skin produces a transient reflex vasoconstriction.[40]

The application of cold and heat locally and at a distance puts the vascular machinery "under a load," as it were, permitting us to gain a still more definite idea of the integrity of the peripheral circulation.

(To be concluded in the August number.)

LOW VOLTAGE CURRENTS *

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Tissues of the human body manifest electrical differentiation. The skin, for example, shows in its various layers different potentials, so that kations and anions may enter or leave these structures depending on the difference in the strength of solutions with which they are electrically in contact. In the deeper organs, membranes of connective tissue are interposed into the water — and salt stream; they carry different electrical superficial potentials.

If we apply an electric current of low voltage to the skin, we can strongly influence the movements of anions and kations, depending on the polarity, the intensity, the duration of flow of the current and the solutions between the electrodes. Furthermore, the current changes the degree of ionization of the electrolytes in the tissues. The anion carries a negative charge to the positive, the kation a positive to the negative pole. Inside of an electrolyte the number of positive and negative ions are always in balance, but near the poles ions tend to discharge where chemical transformations take place. These transformations depend on the nature of the discharging ions, and this on the polarity. At the kathode originates hydrogen, metals, metal hydroxide or bases; at the anode oxygen, chlorine or an acid. Accordingly the biologic effect of the cathode on the skin, which results from the decomposition of sodium chloride and hydrogen, is the formation of sodium hydrochloride which produces local corrosion. Furthermore, the current shows a series of biologic effects for instance on ciliated epithelium, frog larvae and paramecies. In man a longer flow of current shows a fall of leukocytes. The galvanic current increases the absorptive power of the skin. After galvanizing a certain area of the skin the slightest inunction of a weak histamine-ointment produces a wheal formation especially under the anode

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 10, 1935.

while elsewhere it remains free. The direction in which anions or kations are transported is with few exceptions always the same, depending on the position of the poles and the positive or negative charge of the ions. Thus if we place two guinea pigs in a circuit between two electrodes saturated with strychnin nitrate, the animal at the anode dies, the other remaining unaffected. That proves that the transport of the strychnin-ion is only possible in one direction. This we call *electrophoresis* of drugs. We speak of *iontophoresis* if the concerned medicinal is transported in the form of ions. This is possible only by using dissociated solutions (zinc sulphate, strychnin nitrate). We speak of *kataphoresis* when we transport associated molecules including the solving liquid itself from the anode to the kathode. This is an electro-mechanical process. In this way molecules and even colloids may penetrate into the body by ionic absorption through electrophoresis. In all applications it is essential that the epithelium remain undisturbed. Electrophoretic skin anesthesia is only possible on skin, covered by epithelium, not on wounds.

Electrophoretic Action Upon Skin

There is still some confusion about the resistivity of the skin, many still believing that the state of moisture of the skin plays a rôle. This is not the case. Neither the humidity of the skin nor the skin temperature influences conductivity. Not even the degree of blood content of the skin is important. If we ionize a skin area with adrenalin, saturating the anode with the solution, the resistance of the skin does not change even when the blood vessels are contracted, so that the skin assumes the color of ivory. Neither has hyperemia any influence. Only the degree of ionization in the skin is important. The more ions in a dissociated state are present, the better is the conductivity. But the conductivity depends on the nature of the ions, which in turn controls the degree of conductivity. If we plot as a curve the time as an abscisse against the intensity (amperes) as ordinates, the curves give characteristic changes of the conductivity for each ion, if the voltage is kept constant.

The depth of penetration depends upon the intensity of the current. If for example we use a 5 per cent solution of Doryl (a cholin derivative) with only five milliamperes, intense local reddening and some isolated wheals will appear, but no general effect will be noticed even after 30 minutes' application. By increasing the current to fifty milliamperes, five or ten minutes application suffice to produce transpiration, desire to urinate, intestinal peristalsis, and lowering of blood pressure.

The size of the electrodes is of clinical importance, as the density of the current must be held within limits to avoid painful sensations. The greater the surface of the electrodes, the greater the milliamperage which can be introduced. To saturate electrodes with medicinals any material like blotting paper or other suitable fabric may be used. The best is cotton wool because it raises the resistance of the electrodes without diluting the solution. By pressing out the saturated material, the resistance may be doubled. This is an important point. If, to illustrate, we use a plain metallic electrode and paint the underlying skin with potassium iodide, coloring of the skin takes place only around the edge of the electrode. If we desire an effect *under* the electrode, the resistance of the electrode-surface must at least equal the skin resistance. Instead of solutions, some medicaments may be used in the form of ointments.

The speed of ionic migration is relatively very slow, a hydrogen ion at one volt per square centimeter of electrode being transportated 10.8 millimeters per hour, the potassium ion about one-fifth, the sodium ion one-tenth, and the chloride ion one-fifth of that time.

Some characteristic effects of atoms are different in ionized or neutral states. Electrically neutral chlorin is very corrosive while as an ion it is

innocuous; iodin, potassium hydroxid, nitric acid, sulphuric acid decrease in efficiency with dilution but not in an ionized state.

The biologic effects depend mostly on the quality of ions used and on the polarity. It is impossible to separate them from the current itself, as all effects which we can observe depend on electrolytic decomposition and change of potential. The effects can sometimes be very strong. Thus in histamin ionization the capillaries are dilated and may carry blood to a resting muscle about ten times as much as prior to treatment. We may call this a localized oxygen treatment. The capillary microscope reveals a marked acceleration of capillary circulation and an increased number of visualized capillaries in the dilated subpapillary layers. We also observe dilatation of the minute blood vessels and in the smaller arterioles an increase in the flow and permeability. After prolonged treatment the duration of the capillary dilatation is also increased.

There is a marked difference between the injection of a drug and ionization. If we inject substances they go into the interstitial spaces, but ions enter the protoplasm and are not as quickly eliminated.

Electrodiagnostics

We merely mention the diagnostic value of the galvanic current by producing muscular contractions. A refinement of such examinations is the development of the technic for obtaining chronaxy. If we take a galvanic current and try to irritate a muscle, we find that a minimum voltage suffices to produce the threshold contraction. This is called the rheobase. Generally with increasing voltage the muscle contracts more and more intensely but at about the double value of the rheobase suddenly a much stronger contraction takes place. To obtain chronaxy we use this double value of the rheobase expressed in volts and try to determine how long a current of this voltage has to be applied in order to produce a contraction of the muscle. This we accomplish by loading a series of condensers of different capacity with such voltage. They will collect a certain amount of current depending on their size and their discharge will take a different time corresponding to the quantity of electricity they have accumulated. We discharge the single condensers one after another to the muscle to be tested, starting with the smallest, and call chronaxy the time which the smallest condenser giving the first visible contraction needed for discharge through the tissues. This method gives us very good clues to control the improvement of muscular function during treatment.

We cannot here present the detailed indications of the application of the galvanic current nor its special technic. We cite, however, the use of the positive pole for relieving pain (neuralgia, joint effusions). If we intend to apply medicaments, we may have to change the polarity for the different drugs, depending on the electric quality of the ion to be used. Thus we would apply iontophoresis with salicylic ion in cases of atrophy of the muscle from the negative pole on a big surface. In some cases of sciatica we use very big electrodes covering the whole length of the leg, from the hip to the ankle, on each side of the limb and utilize a current up to 150 milliamperes and more.

Clinical Action

Generally we apply in acute diseases greater intensities, say 50 milliamperes, with medium size electrodes from ten to fifteen minutes; in chronic diseases we are content with smaller intensities, say three to five milliamperes, for hours. To prevent corrosion we add a small amount of diluted hydrochloric acid to the kathode.

Experimental studies have shown that after galvanization of several hours duration definite histologic changes take place. At the kathode we observe the initial stage of genuine inflammation, the cells are slightly swelled, the capillaries

exuberantly filled, the interstitial spaces full of secretion with an enormous emigration of leucocytes of a myeloic character taking place. Under the anodic field we see shrinking of all cells, a medium hyperemia, no infiltration, no leukocytes.

Experimentally and clinically we can prove in accordance with the above that a liquid transport takes place. We can desiccate one area and diminish the leukocyte content (inflammatory state, abscess) under the positive pole and produce the opposite effect under the negative pole. After applying 50 milliamperes for two hours local myositis can be observed under the kathode which requires thirty-two hours to subside. This is a specific galvanic inflammation.

While the *galvanic* current is a well defined form of energy, facilitating the regulation of tension, the number of milliamperes, the duration of flow, and the relative direction, the *faradic* current is rather undefined. It gives a more or less steep, sudden and short rise to one side and a very differently shaped, much lower but longer curve of the induced current at closing of the primary circuit to the other side. Furthermore the form of curve depends on the more or less regular formation of sparks, which may change constantly even in one and the same apparatus, apart from the different curve-forms produced in different apparatus by the different sizes and relation of the coils. Dosage by inserting an iron core more or less deeply is inaccurate and offers no possibility for the comparison of results obtained with another apparatus. Yet the current is rather much in use because it is inexpensive, free of risks and capable of producing strong muscular and sensory stimulation.

It stimulates the muscles through their nerve endings and can produce tetany, and is always painful. It is used therapeutically principally to exercise paralyzed muscles and for its tonic effects.

The sinusoidal current is produced by rotating generators and is in use as a commercial alternating current in most electric power houses. Because of its sinusoidal form, the current has every moment another tension, consequently every moment another amount of current flows through the body and we have no possibility of measuring what the patient gets. As every apparatus delivers a different form of curve, this amount may vary considerably in the individual models. The same holds true for the positive and negative phase. The relatively slow rise of the curve along its different bends causes the effects to change at every moment, so that muscular contraction greatly depends on the more or less sudden rise of the current's curve. Accordingly this current has no advantage or special quality and is virtually out of use in many countries. Biologically it may stimulate muscles and nerves and cause muscular contractions, but it is painful and irritating.

Some modalities of these different currents have been developed, especially relating to abrupt closure and breaking or to a more or less smooth wave-like surging and decreasing application of a slow period of, say one or two seconds. In this form most currents are much less painful but on the other hand much less effective, and different devices have been constructed for such applications with subdivisions of groups of single waves with or without change of their amplitude. Apart from the more or less greater comfort, their chief value lies in the psychic effect on the patient.

Great progress was achieved when Leduc published his interrupted galvanic current. It shows a perpendicular rise and horizontal flow of current of regulatable duration and a perpendicular fall to zero. After an interval of controllable duration the same curve is reproduced. Every characteristic of such current is well defined and can be reproduced anywhere. The period can be altered by changing the speed of the motor, the voltage with the intensity of current is now controlled by a rheostat and the duration of flow of the current is regulated by mechanically changing the length of contact through a movable brush. This cur-

rent gives good muscular and sensory excitations. Applied constantly it produces tetany, interrupted muscular contractions and when directed to the brain, general anesthesia. It is less painful than the faradic and sinusoidal currents, but in greater intensities too painful for prolonged application, because its unidirectional curve produces electrolytic effects always in the same direction.

Author's Alternating Current

In 1912 I published the results with a new type of alternating current. This current is the first alternating current by which we can produce and regulate every feature and reproduce the same at will anywhere. The chief value of this current lies in the fact that it is an alternating current and that the electrolytic effects produced in any phase of the current are constantly reversed and neutralized by the succeeding opposite phase. In the absence of appreciable electrolytic effects sensory irritation of this current is insignificant and if the density by using big electrodes is small or by increasing the intensity, even with greater density, there occurs no irritation of the skin. Only muscular contractions in any desired degree take place according to the perpendicular rise of the curve and the duration of flow exceeding the chronaxy limit.

By using small electrodes the current produces some characteristic effects on the sensitive nerves which are very different from those of the faradic current. The sensation is much milder, but depending on the intensity of the current there is an admixture of alternate heat and cold perception. Considering the very small current intensity necessary to produce this effect, there is objectively neither heating nor cooling. By increasing the intensity of the current one experiences a sensation of "pins and needles" and of numbness, which shows beginning inhibition. If one will take for instance a handle electrode and apply the other pole of about one inch diameter to the dorsal surface of the underarm, one will notice that with increasing intensity distally from the different electrode there appears a tingling sensation followed by a diminution of sensitivity first felt as a sense of coldness in the hand. A further rise of the current-intensity produces a state of a disagreeable spasmodic sensation of a few seconds duration, followed by a complete inhibition of sensitivity to pain in the area adjacent to the electrode. The anesthesia is so complete that needle pricks and small operations may be performed without any pain. In this stage a clear dissociation takes place. The pain sensation is completely inhibited while sensation of the lightest touch remains undisturbed.

Applied to the brain this current produces a complete, general anesthesia similar to the Leduc current. The chief difference between these two currents lies in the character of the general anesthesia, which corresponds to the nature of the currents. The Leduc current being unidirectional like the galvanic, produces general anesthesia in a rabbit at seven and eight volts, but one or two additional volts will stop respiration and heart action so that the zone between anesthesia and fatality is very narrow. This is not the case with my alternating current, even a considerable increase of voltage above the anesthesia dose will not affect the animal. Only an increase of fifteen or twenty volts will stop the reflexes and kill the animal. But even after forty volts have stopped respiration and pulse, revival of the animal is possible by prompt rhythmic applications of the same current at respiration rate. As the animal experiments show, the electro-narcosis seems to be harmless. After cutting off the current they recovered almost immediately, only dogs showing for one or two hours a sort of somnolence.

Experimental Data

The following experiment confirms the above contentions. A living rabbit has one electrode fixed on top of the skull, the other one over the lower region of the spine. The very moment the current is applied the rabbit falls to the

side. Fibrillar contractions appear over the whole body on increase of the current. Tonic and clonic contractions appear after opisthotonos, followed by loss of urinary and fecal control. An additional small increase of voltage results after about half a minute in relaxation. Most reflexes except respiration and pulse are inhibited and the animal does not more react to touch or painful irritations. This state can be kept up for hours without harm to the animal. On switching off the current the rabbit becomes immediately awake and reacts normally. On reapplying the current, the animal manifests the same reactions. When this experiment is continued with an increased current, respiration and pulse are arrested. Left in this state the animal would soon die, but if the same current is applied rhythmically, each application produces a spasmodic contraction of the muscles. After interruption of the current respiration is resumed and the animal restored to life. After such strong application it takes several minutes until the animal seems normal again. I have performed three times this intensified experiment on the same rabbit within a few hours. It completely recovered and showed no change in its behavior.

The above described effects have not yet been fully tested on man. This new alternating current however enables us to produce motor and some sensory stimuli by means of alternations that are exactly controllable and reproducible. We are already in a position to state at which intensity of current, duration of flow and number of alternations a minimal contraction or minimal sensation is initiated. Thus we are in possession of a current devoid of the disadvantages of alternating currents as compared with the direct current, suitable for therapeutic and diagnostic purposes.

The current may be applied either in a continuous form or with rhythmical interruptions. These interruptions may be produced either by a metronome or — less advisable — by hand or by a magnetically operated timing device. The interruptions may be equally well produced by any mechanism regulating surging or wave currents.

For muscular contractions I refrained from using surging or wave interruptions as the sudden break and closure of the current is much more effective and gives quicker therapeutic results. For very sensitive patients we can smooth the effect and systematically habituate the patient to tolerate the current by starting with very weak and gradually increasing the intensity. One of the great advantages lies in the fact that by increasing the intensity we gradually produce inhibitions of sensory irritations, as shown above. Thus we are enabled to apply much higher intensities with this than with any other direct or alternating current. The stronger the dosage, the less sensation the patient experiences in the skin, the only limitation being dictated by the muscular contractions. Too intense a current results in painful muscular contractions. Furthermore, there is no shock when interrupting the current at full strength.

Therapeutic Results

The therapeutic application of this current is indicated in muscular impairment ranging from debility to complete palsy. I refer to two cases. After an injury with fracture of the humerus complete palsy developed in the median nerve with no sign of improvement after eight weeks. There was a partial degeneration-reaction. On faradic excitation a worm-like contraction occurred. With this current the same worm-like manifestation appeared but after a few minutes it changed to the normal prolonged jerk-like reaction. In a few weeks all affected muscles were restored to normal.

The child of a woman-physician was born with a complete left facial palsy from forceps delivery. The left eye could not be closed and there was a marked asymmetry of the face. There were difficulties in feeding, as suckling was im-

paired. After three and one-half weeks no trace of motion appeared. I advised treatment by this new current. The infant stood the applications very well and after six treatments of ten to twenty minutes duration full recovery took place.

In infantile paralysis very good results were obtained. If the patients start treatment early, soon after the febrile state has subsided, very often full recovery takes place. A brother and a sister eleven and twelve years old were simultaneously taken ill with this disease. The brother died, the girl came under my care with palsy of both legs up to the lumbar region and partial palsy of the left upper extremity. Within a few months complete recovery was obtained. She was able to walk without limping, to perform gymnastics and to dance. She grew very tall in the following years. She is now about thirty-five years without the slightest symptom.

A young man of twenty-one who had suffered infantile paralysis at nineteen, was completely paralyzed from the middle of the dorsal spine downward. The muscles of the lower extremities and of the hip had fully atrophied. He could only walk on crutches with the aid of another person, as his legs did not afford any support. In the first months it was not possible to elicit any muscular response on electric excitation. Gradually some small and slow contraction could be elicited. By daily treatment with interruptions of a few weeks he improved in the course of two years so far that he now walks without crutches on two sticks. At home he walks even with one stick.

In advanced cases with highly atrophied muscles, for instance if the quadriceps seems totally atrophied and reduced to a fascia-like structure and the microscopic examination does not show any muscle cell but a de-differentiation to the histoid type, it is often possible by frequent application of this current, combined with local diathermy, to induce a new differentiation and production of muscle cells. Accordingly the prognosis even in cases with very advanced atrophy is not always absolutely unfavorable. All patients should be accorded the possible benefit to be had from prolonged treatment.

If muscles are only debilitated or atrophied by inactivity, rapid recovery is the rule. In fractures, for instance, one or two weeks' treatment often suffices to reeducate the wasted muscles. After laparotomy a few treatments may prove adequate to restore to full activity the muscles of the abdominal wall. In obstetric practice this treatment prevents relaxation and flabbiness of the abdominal muscles. In cases of fracture of the extremities we prevent muscular atrophy by this treatment while the limb is in the cast, through suitable openings. This enables the patient after removal of the plaster to regain much quicker the voluntary use of his limb. Furthermore, the improvement of circulation by this exercise during the healing of the bone has a very favorable influence on the formation of callus and hastens recovery.

I have made a very extended use of this rhythmically interrupted current for the reduction of local and general adiposity. The above described characteristics of this current render it most suitable for this kind of treatment, as it produces no disagreeable sensation even when strongly applied. In this regard neither the Leduc nor the Bergonié faradic current compare in effectiveness, as they are much more irritating. I have seen only two patients among many hundreds who did not tolerate this treatment. These were men who had undergone severe electric shocks by industrial currents and suffered from electrophobia. In 1926 I presented a paper before the American Congress of Physical Therapy in Chicago and reported on 300 cases of obesity, 150 before and 150 after the war, so that the change of living standard can not be considered as a factor. These 300 cases lost during and after the treatment one and one-half tons of fat (exactly 1448.6 kilograms). The average loss for each treatment was 283 grams. The loss per hour of treatment was 338 grams. The loss of

weight is a very complicated phenomenon. The reduction seen in some cases after each treatment is not essential, as it mostly affects water and this generally concerns patients whose alkali reserve and electrolyte concentration react to these procedures.

We always prescribe during this treatment and for a period of three months a diet adapted to the weight and constitution of the individual patient. This diet is not a starvation régime. Each patient is given the full number of required calories. Only carbohydrates, fats, and liquid intake is restricted. They are little restricted in the amount of food they may eat, provided it is properly selected and prepared. It is quite a common observation that many patients do not lose considerably in weight during the muscle exercises. They may lose only three or five kilos in a month. But after stopping the treatment sometimes during a whole year, they gradually come down in weight without further treatment or diet. Other individuals lose considerably during the treatment. It would lead us too far to enter into a discussion of the mechanism by which reduction is effected. Obviously it varies in different types and individuals. The muscle work produced during an hour's treatment by putting nearly all muscles of the system into rhythmical contraction seems considerable, yet the basal metabolism during treatment is not much affected. Pulse and respiration are more often decreased than increased after an hour of intense labor. In the presence of the actually achieved results — loss in body weight and reduction of circumference of limbs and waist — increased production of lipolytic ferments not only during but for a time after the treatment must be the rule. I describe the mechanism as a change in the constitution by placing it on another metabolic level. The treatment must be carried out in such a way that fatigue is avoided. We start for a few minutes with low intensity and increase the time and dose according to individual requirements. The same applies to the number of treatments and periods of rest.

Still more difficult to explain and to understand is the reduction effect on localized areas of fatty deposits. For instance at the nape of the neck, double chin, cheeks, breasts, legs, and the like.

There are many questions in electrophysiology which are still far from solved. Considering the biologic object as a complex of localized, mixed and general distribution of potentials, ionized molecules, stable and moving charges, we need not be astonished to observe effects by electricity. Yet the manner of application is essential for the production of certain effects. It seems that the application of a uniform current or current-form acts differently than a pulsating or frequently changing type. Biologic investigation of this current is in its incipient stage, but the clinical application shows some peculiar results. For tinnitus caused by the pathologic production of an electric current affecting the auditory nerve and so producing the subjective sounds and noises I apply this current on account of its inhibitory effects on the sensitivity of the skin. Good results were obtained especially in combination with diathermy by glass condensers.

A woman in the forties suffering since youth from otosclerosis developed in the last years an aggravation of her symptoms with increasing deafness and troublesome tinnitus. In addition she suffered from giddiness and even in the recumbent posture, sometimes even fearing of falling out of bed. The above described application improved all symptoms. She resumed her work as a stenographer, lost completely her giddiness and tinnitus. After some months slight giddiness and tinnitus recurred, but a few treatments sufficed to relieve her condition. She reports from time to time for a few treatments and is able to do her work without interruption. Of course, her otosclerosis is not cured. She has still reduced hearing, but the advanced stage of otosclerosis has been lessened to the state she was in about twenty years ago.

A gentleman developed increasingly severe attacks of deafness and tinnitus, which made it often impossible for him to follow discussions, so that he was at the point of resigning from an important position. Four weeks of daily treatment enabled him

to continue his work. He occasionally suffers from slight symptoms of the former character.

In neuralgias I have made the same use of the inhibitory effect of the current in some cases with definite results, in others with relief of pain only while the current was applied. The inhibitory effect on centripetal nerve conduction seems to be more marked and more lasting if rhythmical applications of a frequency of 60 per minute were given.

Conclusions

Low voltage therapy has entered the era of scientific application.

For unidirectional currents we are no longer restricted to the simple galvanic current with its rhythmical interrupted surging or wave-like modification, but we are enriched by the Leduc current whose biologic effects have not been sufficiently studied.

The sinusoidal current is negligible on account of the unphysiologic form of the curve and its effect which can be improved by other currents.

The faradic current is important for its stimulating effect, but has the disadvantage of being unsufficiently defined and not controllable for diagnostic and therapeutic comparisons.

The above described new interrupted alternating current with its special characteristics afford us added clinical opportunity to use an alternating current whose intensity, duration of flow and other features (number of alternations, duration of period) are well defined and can be reproduced exactly with any similar apparatus.

Its stimulating effect is at least the same as that of the faradic current, but it can be applied in much stronger intensities on account of its inhibitory effect on the sensitivity of the skin. It has the further advantage of more exact dosage and control for diagnostic and therapeutic purposes.

Finding New Lung Function Solves Human Blood Puzzle

Studies which clear up a fifty-year-old puzzle about human blood were reported by Dr. William H. Howell, emeritus professor of physiology in the Johns Hopkins University, at the autumn meeting of the National Academy of Sciences.

The puzzle was to find where the platelets of the blood are formed. These platelets are little flattened disks which are important because one of their functions is to make blood clot after it has been shed.

The platelets are formed in the lungs, Dr. Howell found.

This is an entirely new idea. Although the platelets were discovered more than 50 years ago and there have been all kinds of theories as to their origin, function and fate, no one has ever thought of looking in the lungs for their birthplace. Until now medical scientists have thought these important platelets were formed in the marrow of bones where the red blood cells and many of the white blood cells are made. The generally accepted view, proposed by Wright, is that they are produced in the marrow from a species of giant cell, to which Dr. Howell many years ago gave the name megacaryocyte.

Now Dr. Howell comes along with the experimental proof that the platelets are made in the lungs. The first evidence was finding that as the blood flows through the lungs it picks up platelets. The arteries always contain more than the veins.

Further evidence was obtained by examining bits of lung tissue under the microscope. By a special technic, the platelets were stained intensely, so that they showed up clearly under the microscope.

"I have been able to show," Dr. Howell reported, "that they are produced, as a sort of solid secretion, by the giant cells, megacaryocytes, of the lungs.

"Megacaryocytes," he explained, "have been found in the lungs by many investigators, but they are usually supposed to be sort of accidental constituents, cells that have escaped from the bone marrow and have been caught in the capillaries (tiny blood vessels) of the lungs, there to undergo degeneration.

"But my observations show, on the contrary, that they are actively growing cells whose cytoplasm is composed of platelet material and which branches out into the blood capillaries sometimes for quite a distance. Then processes break off and are carried off in the blood stream and break up by fragmentation into the tiny platelets." — *Science News Letter.*

INFLUENCE OF SHORT WAVE RADIATION ON CONSTITUENTS OF BLOOD *

DISRAELI KOBAK, M.D.

CHICAGO

Within the past decade considerable research has been developed with reference to the therapeutic value of short electric oscillations from 30 to 3 meters in length. Clinically this form of radiation has already been shown to more favorably influence certain types of inflammatory and pyogenic processes, and to evoke a deeper and more prolonged heating action than was heretofore attained with any of the conventional thermogenic sources at our disposal. First interpreted as possessing occult biologic properties characterized as specific in nature, increasing experience has proved that the primary action of short waves is essentially that of a diffusive and selective heating, due to displacement and conduction phenomena inherent in short and particularly ultrashort electric fields. The disintegration of granulomas in geranium plants caused by bacillus tumefaciens, as demonstrated by Gosset[1] and his coworkers, the disappearance of inoculated tumors in animals, as pointed out by Schereschewsky[2] and Pflomm,[3] and proof that electrolytes, metabolites and the fixed and fluid tissues of the body could be selectively heated by different wavelengths were sufficient to provoke the widest interest in the problem.

It hardly requires emphasis that these uncommon findings aroused profound interest in the expectation that they may prove of clinical value. Though it was recognized that the conditions existing in the experimental laboratory are not identical with those at the bedside, yet the experimental results were so striking in nature from the standpoint of á more or less specific influence on tissues, that it was realized that in the short waves we have possibly an agency that might change classic therapeutic concepts. Accordingly specially qualified investigators have undertaken lines of research on their effect on the human organism. Much work has already been accomplished, but the field is so vast and the time that has elapsed so short that the cumulative literature has far from brought us a solution of many important problems, but nevertheless has pointed out important indices that we deal with potent effects meriting exhaustive study for potential clinical utilization.

Effect of Short Waves on Blood

Considering the rôle played by whole blood and its components in inflammatory and infectious diseases, especially from the standpoint of curative hyperemia, it was natural that one of the main experimental efforts should have been devoted to a cytologic and serologic study of the effects of short waves. For these the web of a frog suggested itself as an excellent medium. Summarizing the entire research of Pflomm and others, the findings are formulated as follows:

1. Short waves produce a dilatation of the capillaries, small arteries and veins, the same as any other heat stimulus. This dilatation affects an acceleration of the blood stream in the form of an active hyperemia.

2. Intense or prolonged application of short waves shows in the web of the frog to result in an injury to the circulation. If the capillaries are

* Read at the Mid-Western Sectional Meeting of the American Congress of Physical Therapy, Mayo Clinic, Rochester, Minnesota, March 4, 1936; and at the Eastern Sectional Meeting, Philadelphia, May 27, 1936.

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dilated to an excessive degree there appears at first a slowing and finally a complete arrest of the circulation, so much so that it may even result in a return flow from the veins to the capillaries.

3. This excessive dilatation continues to exist for a number of days (up to 14) and does not contract after injection of adrenalin or faradic stimulation.

4. It has been accepted that this apparent paralysis of the vessel walls results from an influence of the short waves on the sympathetic nervous system, whose tonus is greatly reduced and even temporarily paralyzed.

5. Normal blood corpuscles react to radiation by becoming darker in color, and unless the condenser field effect is interrupted, coagulation and necrosis ensue.

6. All the above findings can be modified and even controlled when the dosage is kept within physiologic limits.

These studies clearly indicate that the short and ultrashort waves properly applied produce a degree of hyperemia experience has shown to be useful in the therapy of inflammatory and infectious conditions. On the other hand we also see that overdosage is apt to produce pathologic stasis and suppression of tissue metabolism. On the basis of this concept further studies have been undertaken, the results of which are as uniform as they are indicative of a definite influence of short wave radiation on the blood and its separate components.

McLennan[4] demonstrated that shorter wavelengths produce greater heating effects on blood subjected to condenser field action. With the blood grouped as whole blood, whole blood minus the corpuscles, and whole blood minus corpuscles and with the removal of electrolytes by dialysis, leaving only the proteins in the serum, the temperature in each group varies with its components at wavelengths of 43, 15 and 9 meters. Schliephake[5] also showed that when equal quantities of whole blood, serum and clots from the same blood were exposed to a field of 3 meters for three minutes, the temperature of the whole blood rose to 57, the serum to about 47, and the clot to about 52.7 degrees C. From this it would appear that the red corpuscles even in the whole blood become heated more strongly than the serum in which they are suspended. According to Schaefer[6] the absorption of electrical energy by erythrocytes from a 3 meter condenser field is greater than by the surrounding serum. This is explained as due to a capacitive bridging over by the conductive cell membrane, a phenomenon especially noticeable with the shorter wavelengths. Schaefer found that the conductivity of blood corpuscles was 7.5 times greater with wavelengths between 2—3 m. than with longer ones.

While it is known that short electric waves produce definite heating of internal structures, study of their action on some of the protein components of the blood has indicated that they also possess a selective action. Demonstration of their influence on toxins, opsonins and colloids is now explained on the basis of a special action exerted by the electric fields on the smallest objects, including the very electrical charges surrounding these particles. The ions are said to be subjected to a power drag and distortion in the direction of the field, thus increasing motion, which in turn creates the familiar state of heat.

Selective Influence

However one may attempt to explain the special action of ultrashort electric fields, there is definite evidence that we have to deal with a characteristic influence different from that of any other thermal agency. Studying the susceptibility of colloids in human serum, Recknagel and Schliephake[7]

showed that when serum in test tubes was subjected to a condenser field and the temperature maintained at a constant level, the viscosity of the serum increased within the first ten minutes and then decreased. Szymanowsky and Hicks[8] neutralized diphtheria toxins by exposure to a 2 meter field. Recknagel and Schliephake found that anti-diphtheria serum was also influenced by somewhat similar experiments. "Mice which had been injected with lethal doses of diphtheria toxins escaped death when given untreated serum. With serum exposed to the field for ½ to ¾ of an hour, the effect of the anti-toxin was completely lost and all the animals so treated died."

Jorns[9] and others have demonstrated that condenser fields produce especially localized selective phenomena on protein molecules. Under normal dosage phagocytosis may be stimulated, and under intense dosage depressed. In the same manner the phagocytic index has been increased in the living body. Jorns regards the above as a specific action on the serum proteins by condenser fields independent of the influence of temperature. According to Izar,[10] normal and syphilitic serum exposed for 20 minutes to 4, 8, and 15 meters showed an increase in the non-specific anti-complementary, but not in the complement fixing powers. The amount of increase varied inversely to the wavelength. The agglutinin titer of fresh human serum against typhoid bacilli was lowered by ultrashort but uninfluenced short waves.

As regards the behavior of various constituents of the blood, v. Oettingen and Schultze-Rhonhof[11] have shown that the precipitation rate of the red cells in rabbits is at first markedly decreased and then increased after each treatment. The lymphocytes undergo a similar change, falling sharply below normal and gradually rising to a plateau-like curve. The behavior of the monocytes, basophils and eosinophils is normal. Similar studies by Pflomm show that after a short falling off of the leucocytes, they temporarily increase again and finally resume their normal level. Histologic investigations show that the leucocyte drop is ascribable to destruction of the white cells with a large number of them being held back in the periphery of the vessels in the radiated region. Thrombocytes are slightly increased by the influence of the ultrashort waves, but only for a comparatively short time, as is shown by the following table (Pflomm[3]):

Before radiation	90	thrombocytes	per	1000	erythrocytes
1 hour after radiation	105	thrombocytes	per	1000	erythrocytes
2 hours after radiation	100	thrombocytes	per	1000	erythrocytes
3 hours after radiation	93	thrombocytes	per	1000	erythrocytes

Blood clotting becomes so markedly increased that even the addition of sodium citrate has no appreciable influence. This is in accord with my observation that short wave radiation markedly reduces the clotting time of blood. The literature on this problem contains many confusing references to findings in animals, which however seem to me to be of only academic interest. So far as the clotting time in humans is concerned the uniform experiences can perhaps best be explained by the effect of the short waves on the calcium ions. There is no doubt in the light of the mechanism of normal blood clotting that these ions are reduced in the blood but increased in the tissues, where they abstract much of the fluid content from the walls of the blood vessels. It has also been advanced that this disturbed physicochemical balance influences the tonus of the vegetative nervous system, but this requires further substantiation. The refractometric index often showed an increase indicating a state of hydration of the colloid particles of the blood plasma.

The hydrogen ion concentration also increased. This important observation was studied on blood taken from the vein of individuals in a region that had been subjected to ultrashort radiation, care having been taken to exclude

any external influences apt to interfere with the uniformity of results. Seven patients, all afflicted with subacute monoarthritis were selected as coming near equality in the nature of the illness, past history and physical makeup. All patients were males between 40 and 50 years of age. The affected joints of these patients were treated with a six meter wavelength for 15 minutes with the result that the pH in the serum that averaged before radiation 7.93, showed 7.62 after radiation.

Izar[12] found a reduction in the urea of humans when treated through the kidney with an 8 meter wavelength. Basing on the known fact that heating of the organism produces an increased exhaustion of albumin, Pflomm[3] estimated that blood taken from a radiated region should contain the by-products of the destroyed albumin. Contrary to his expectations the nitrogen content of the blood proved to be less than normal in spite of intensive radiation. So far as influence on the blood sugar is concerned, I have found both a reduction and a rise in the blood sugar in the human when treated through the liver, an observation which partially substantiates the findings of Pflomm. Schliephake and Weissenberg[13] have also noted reductions in the blood sugar of rabbits treated in the region of the pancreas, while irradiation of the brain produced a rise in the blood sugar to double its value.

Effect on Colloid Particles of Blood

From what has been said it is clear that short and ultrashort waves have a definite influence upon certain constituents of the blood. The interpretation, if not the validity of some of these findings would have been less subject to question had they been explained on the basis of heat, rather than selective effects inherent in ultrashort wavelengths. The fact that many of the studies were performed with materials treated outside of the body and upon animals from diseases encountered in the human, also tends to weaken some of the conclusions. For these reasons my observations were drawn from 100 unselected hospitalized patients sent to my services, where short waves were administered by apparatus of different makes and wavelengths. The majority of these patients belonged to the arthritic group, but in order to broaden our observation we included types of affections in which physical therapy is not ordinarily prescribed. The observations were extended to include before and after determinations of the reaction on the suspension stability of the red cells or sedimentation rate, the viscosity rate, changes in the blood sugar, influence on the refractometric index and on the brownian motion of ultramicroscopic particles under dark field illumination (table 1). The Friedländer type of tube was employed for observation of sedimentation rates, with readings of 10 minutes as compared to the control serum. The normal sinking of the red corpuscles is about 3 hours, the abnormal rate varying with the severity of the condition, which may drop very rapidly or very slowly (chart 1).

The normal viscosity of the serum is 1.75 times that of water. Whenever the protein particles in the serum become dehydrated or hydrated, the viscosity of the serum is lowered or increased, the usual range being 1.5 to 2.

The terms hydration and dehydration as used in physical chemistry and applied to the proteins of the serum, refer to the water exchange, along with other metabolites. When sugar, urea and other constituents of the protein molecule are separated and go into solution, a certain amount of water also leaves the protein. Again, when the chemical ingredients of the blood are readsorbed by the protein, water accompanies them and it is also combined

TABLE 1. — *Influence of Short and Ultrashort Waves on the Plasma of Blood.*

NOTES	PATIENT	REFRACTOMETRIC INDEX		VISCOSITY		BLOOD SUGAR		SEDIMENTATION RATE		TREATMENT	
		Before	After	Before	After	Before	After	Before	After	Time	Wave Length
[illegible]	Mr. C.	1.3535	1.3550	[illegible]	[illegible]	98	88	30 min	28 min	10 min	6 m
	Mr. F.	1.3520	1.3520	[illegible]	[illegible]	96	94	190 min	126 min	20 min	14½ m
	R. O'D.	1.3515	1.3515	[illegible]	[illegible]	84	102	67 min	80 min	20 min	6 m
[illegible]	L. C.	1.3520	1.3530	[illegible]	[illegible]	75	80	66 min	68 min	20 min	14½ m
[illegible]	I. H.	1.3540	1.3500	[illegible]	[illegible]	103	85	72 min	74 min	10 min	6 m
	N. U.	1.3525	1.3520	[illegible]	[illegible]	79	96	51 min	49 min	20 min	14½ m
[illegible]	J. S.	1.3520	1.3535	[illegible]	[illegible]	100	104	177 min	83 min	20 min	6 m
[illegible]	M. T.	1.3520	1.3530	[illegible]	[illegible]	70	90	49 min	45 min	20 min	6 m
	V. G.	1.3515	1.3520	[illegible]	[illegible]	99	81	90 min	54 min	20 min	21 m
[illegible]	M. D.	1.3530	1.3550	[illegible]	[illegible]	70	73	56 min	96 min	20 min	14½ m
[illegible]	E. T.	1.3505	1.3525	[illegible]	[illegible]	90	82	8 min	8 min	20 min	6 m
[illegible]	Z. H.	1.3500	1.3505	[illegible]	[illegible]	90	88	59 min	27 min	30 min	6 m
	NORMALS	1.3500		[illegible]		80-100		90-180 min			
	CHANGES	UP	DOWN	UP	DOWN	UP	DOWN	UP	DOWN		
	NUMBER	8	2	7	2	6	6	4	7		
	NO CHANGE	2		3		0		1			

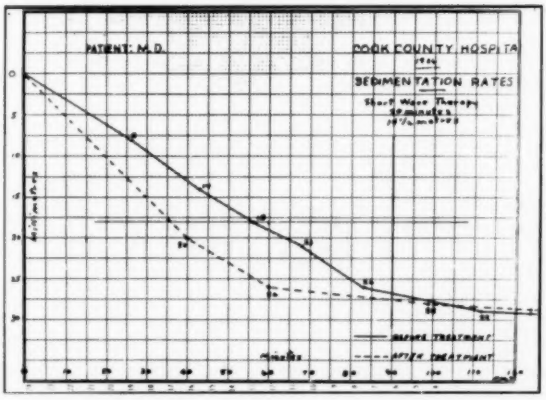

Chart 1. — Increase of sedimentation rate by short wave.

with the molecule. Internal temperature is known to influence blood sugar, hence it should also be affected by short wave radiation. With mild and short treatments over the hepatic region the evolution of electric energy into caloric units tends to produce a hyperglycemia but no glycosuria.

The refractometric index of the serum is obtained by Abbé's refractometer and is used to determine the adsorptive capacity of the protein particles. It is as constant an index to serum as the temperature is to the body. The average normal reading is 1.3500. A high reading denotes an increase of globulin at the expense of albumin. The initial effect of short wave radiation is to raise the refractometric index and then to lower it (table 2).

The serum of normal individuals viewed in a dark field showed an enormous number of actively motile protein particles. These are uniform in size and moderately diffract the light. They do not however furnish an insight of the finer activities of the blood. In health the particles are rela-

TABLE 2. — *Standards of Variation in Tests of Colloid Particles of Blood.*

	Normal (Dispersion)	Dehydration	Hydration
Sedimentation rate	1½ to 3 hours	Rapid	Slower
Viscosity	$\frac{1.5}{1}$ or $\frac{3}{2}$ (average $\frac{1.75}{1}$)	Below	Above
Refractometric index	1.3500	Below	Above
Sugar	90 to 110 mgm.	Above	Below
Urea	20 to 40 mgm.	Above	Below
Albumin-globumin ratio - - - - - - -		Albumin -	Globumin

tively small and in constant brownian motion. In disease the motion is more sluggish or totally arrested. The particles either are thinned out by lysis, become amicronic in size, or tend to clump, precipitate or assume giant size in the form of rings. Precipitation is a fairly constant phenomenon of the initial stage of short wave treatment, and dispersion the desirable and eventual effect.

Comment

In the foregoing no attempt has been made to enter into details, the object of this presentation being briefly to review and to correlate available experimental data of certain effects of short and ultrashort radiation. From what has been pointed out it should be clear that in short waves we have an agency which, though thermogenic in function nevertheless greatly differs from all known thermo-reactions by special effects on animal cells, especially the blood, both as whole and separated in its components parts. While therapeutically the principal effect of short waves is dependent on an active hyperemia artificially produced, it differs from the same influences on the circulation produced by other methods in the prolonged and sustained continuation of the increased circulation. To this should be added certain metabolic influences which are not attainable with conventional diathermy. The manifest effect of the short and especially the ultrashort waves on the tonus of the autonomic system suggests a certain biophysical action on nerve structures—inherent in a definite range of wavelengths.

Conclusions

1. Short wave therapy apparently influences the various constituents of the blood.

2. Minimal dosage of short wave radiation tends to (a) raise the refractometric index, (b) increase the viscosity, (c) raise and lower the blood sugar, (d) increase the sedimentation rate.

3. The changes produced are only significant of the internal influence of short waves, and require more detailed correlation on actual clinical material.

4. The applicability of the experimental data to therapy is clearly indicated by their biophysical and biochemical character, the ultrashort regions having a more selective action and a more prolonged heating effect than is found in the longer regions of short wave diathermy.

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UNUSUAL COMPLICATION OF TREATMENT BY HYPERTHERMY

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The treatment of disease by means of high temperature has become widespread in recent years. In the wake of all new forms of therapy follow the sequelae resulting from their use. These constitute as much an integral part of the methods as does their employment or therapeutic result. The following case illustrates this point:

A 24 year old white male developed a specific urethritis in October 1935, which was inadequately treated by himself at home. Approximately one month later, an acute migratory polyarthritis developed, involving the various larger joints — ankles, knees, hips, wrists, and shoulders. With the institution of treatment all local signs subsided, as did the migratory character of the polyarthritis. However, the left knee continued to grow larger and more painful, and presented the typical appearance of a moderate effusion into the joint. It is to be emphasized that the patient's past history was negative, and that at this time as well as in former examinations (during his acute illness) the patient had no neurologic manifestations. On November 16, 1935, eight days after the development of the joint condition and five weeks after the initial infection, the patient was transferred to Mount Sinai Hospital, New York City. On

his arrival at the hospital, the findings were: temperature 103 degrees F., marked swelling of the left knee with fluid accumulation in the joint space and some infiltration of the peri-articular structure. No urethral discharge; prostate normal; prostatic smear negative. Heart and lungs normal. No petechiae. B.P. 130/80. Hgb. 90 per cent, W.B.C. 12,000, Polys. 72 per cent, Lymphs. 22 per cent, Monos. 5 per cent, Eosin. 1 per cent. Sedimentation time very rapid. GC complement fixation test, blood Wassermann, blood culture, and urine were all negative.

During the first and second days of his hospital stay, the patient's temperature ranged between 102 degrees and 103 degrees F. On the third day, (November 19th) he received his first hyperthermic treatment in the heat cabinet, where body temperature was raised to 106 degrees F. and maintained there for five hours. The next day, the patient felt quite weak but was emphatic in declaring that the affected joint was much less painful and that there was freer motion. At this time, several small first and second degree burns on the anterior aspect of the middle third of the left thigh were evident. He had noticed that towards the end of the treatment on the previous day, this area had begun to pain and smart. Treatment, however, had not been terminated. On the fourth day after admission, his temperature had fallen to 100 and on the fifth day to 99 degrees F. with considerable improvement in the condition of the left knee. On the sixth day he again received hyperthermy in the cabinet, and on the seventh day the temperature was within normal range, where it remained for the next three days until his discharge on November 26th. During the last two days of his stay he received diathermy locally to his knee. His status upon discharge was satisfactory. The joint swelling was only minimal, and there was only a slight limp in his gait. He remained in bed at home for the following week, and was then seen in the Department of Physical Therapy at Montefiore Hospital on December 7th as an ambulatory patient.

Several important findings were noticed for the first time. In the left lower extremity, there was a Babinski reflex (confirmatory signs: Chaddock, Gordon, and Oppenheimer also positive), inexhaustible ankle clonus, and exhaustible patellar clonus: on the right side, there was an equivocal Babinski, a positive Gordon reflex, and exhaustible ankle clonus. The knee jerks were hyperactive on both sides, but equal. No other pathologic reflexes were present in the lower extremities, and there were no sensory changes. Cremasteric and abdominal reflexes were elicited. The lower left abdominal reflex was very feeble and exhaustible. The reflexes of the upper extremities and tests for coordination were normal. In the lower extremities, however, there was spasticity of the flexor and extensor groups of both knees, which was more marked on the left, with some slight degree of foot drop on the left and definite spastic gait. Eye grounds were normal, bladder and rectal control unimpaired.

Because of the patient's mental anxiety, treatment was symptomatic. He received mild radiant heat followed by massage, to both lower extremities. Observations were made every few days, so that changes in his condition were readily noted. From the very outset, the neurologic signs began to change. One week later the spasticity in the lower limbs was much decreased and his gait improved. The ankle clonus on the left side had now become exhaustible, while that on the right could not be easily elicited. Patellar clonus was absent bilaterally. The Babinski and confirmatory signs were still positive on the left. On the right there was now a normal plantar response. Two weeks later (three weeks after fever therapy) the patient's gait had become normal. There was no ankle clonus on either side, and the Babinski reflex on the left was also absent, although the Gordon sign was still positive. Two weeks after this examination, the patient presented no abnormal neurologic evidence, and to date, a half year after cessation of treatment, the patient is still without signs or symptoms.

Discussion

The appearance and rapid amelioration of frank signs of pyramidal tract involvement in an individual, in whom there were no such findings prior to treatment by hyperthermy, is not easy to evaluate. Some possibilities may be ruled out with certainty. Although invasion of the spinal fluid and cord has been described as sequelae of blood stream infection or as a metastatic deposition of gonococci, the clinical features and subsequent recovery obviate this diagnosis. Syphilis of the central nervous system is also not very probable because of the negative history, the absence of a specific lesion, the negative serum, and the patient's recovery without specific medication. The presence of some latent neurologic or structural defect, like multiple sclerosis or spina bifida, which had

lain dormant and was discovered only after hyperpyrexia had brought it out, was also excluded because the disease pattern and course did not fit such possibilities. Examination of the spinal fluid would have been the ideal confirmatory test at this point, but unfortunately could not be carried out.

The morphologic and humoral changes produced by high temperatures have been the subject of much investigation. Jacobsen and Hosoi[1] have shown that their experimental animals (dogs, guinea-pigs, and rats), when subjected to heating by ultrahigh frequency oscillator, showed marked changes in the nervous system which they attributed to direct effect of the heat. Among these were congestion of the brain, varying degrees of meningeal as well as focal brain hemorrhages, and chromatolysis of the ganglion cells. The duration of the heating and the maximum temperature reached in their experiments were of the same magnitude as those used therapeutically in human beings. Their results indicate that there may be a causal relationship between the neurologic changes in this patient, and the application of a powerful physical agent, heat, to the body.

Summary

Attention is called to the appearance of bilateral pyramidal tract signs in a young adult following treatment by hyperthermy. The character of the involvement and its temporary nature go hand in hand with changes in the nervous system described by experimental workers. For the present, the actual implication of hyperthermy as the etiologic factor must be left unproved. It is important, however, to stress the possibility of such a relationship because the changes produced may very well become permanent, instead of clearing up as they did so fortunately in this patient.

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Note: My thanks are extended to Dr. Abraham Jezer and Dr. William Bierman for furnishing the reports of this patient's stay at Mount Sinai Hospital.

Postponement of First International Conference on Fever Therapy

The First International Conference on Fever Therapy, originally scheduled for the end of September, 1936, has been postponed because of numerous requests, to permit more time for the preparation of material. The new dates set for this Conference are *March 30th to April 2nd, 1937.* The sessions will be held at the College of Physicians and Surgeons, Columbia University, New York City.

The advances in the treatment of gonorrhea, syphilis, and other diseases by pyretotherapy are of great social significance. Invitations on behalf of the Conference will be issued by the State Department of the United States to Ministries of Public Health of other countries. The Medical Departments of the Army, the Navy, and the Public Health Service of the U. S. A. will be represented, as will also the New York City Departments of Health and of Hospitals.

A tour has been arranged to take place immediately following the Conference, to enable physicians to observe the techniques employed in fever therapy in some of the hospitals in the eastern section of the United States. Among the institutions to be visited are the Strong Memorial Hospital of the University of Rochester, New York; the Henry Ford Hospital, Detroit; the Mayo Clinic, Rochester, Minnesota; the Kettering Institute for Medical Research at the Miami Valley Hospital, Dayton; Northwestern University Medical School, Chicago.

Further information regarding the Conference may be obtained from the General Secretary, Dr. William Bierman, 471 Park Avenue, New York City, U. S. A.

TEMPERATURE ELEVATIONS DURING PELVIC SHORT OR ULTRASHORT WAVE TREATMENT

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The problem of inducing high local temperatures in the pelvis presents many interesting considerations from the physical point of view. In accordance with previous conclusions[1] the production of heat in tissue by the high frequency field can be studied in a semi-quantitative fashion on the basis of certain fundamental principles. By this means it is readily seen that for intense local heating, a method of application must be adopted which will prevent the spread of the high frequency energy into large volumes of tissue. Unless this is done, instead of obtaining an appreciable local rise of temperature, the energy will be dissipated and lead to a relatively lower rise of temperature over a large part of the body or, because of the effect of the circulation, to a slight elevation of the bodily temperature.

A localization of the field may be accomplished by a suitable arrangement of electrodes. The plate technic, in which electrodes are adjusted on either side of the pelvis, is obviously ill suited to this purpose. With this technic, the field may be expected to spread over a large mass of tissue, leading to no significant temperature elevation. The cuff method, with a circular electrode about each thigh connected to one terminal, and a belt about the abdomen connected to the other terminal, is somewhat more suitable for the production of a local effect, but even here the mass of tissue permeated by the field is still very large, so that a great amount of energy would be required to produce appreciable heating. We can obtain a rough idea of the degree of localization actually required if we consider that for 10 kilograms of dead tissue about twenty watts acting for twenty minutes are necessary for a rise of one degree F.* In order to produce a twelve degree elevation in temperature in twenty minutes with 20 watts** actually available, we should have to limit the zone of effective heating to a region with a mass of 0.83 kilograms, even in the artificial case considered. Obviously, the entire pelvis and upper parts of the thighs represent considerably too much mass.

There is one extremely valuable method which on a theoretic basis, should be expected to yield a high degree of localization, and hence high elevation of temperature. This method depends upon the characteristics of the field about an electrode inserted into the tissue mass. If the electrode is small compared to the entire tissue, we can approximate conditions by considering the latter to be infinite. Since the electrode is small, no great error, except in its immediate neighborhood, will be introduced if we consider it to be spherical, even if it be actually, appreciably aspherical. The current densities outside the electrode (both conductive and displacement)

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* Excluding all losses due to radiation, evaporation, conduction, and convection, as well as all effects due to altered metabolism.

** Because of the tremendous inefficiency of the process of heating the living body, we assume as a rough working estimate that only 10 per cent of the possible output of the machine actually is delivered and remains in the tissues. Thus with 20 watts in dead tissue with all losses excluded, we may expect the heating to be of the same order as it would be in the body with 200 watts applied. Since this estimate of the efficiency is used throughout this discussion, its exact value has no bearing on the validity of the comparative conclusions.

in such a case are distributed uniformly about the electrode and vary in intensity along the radius, inversely as the square of the distance from the center. The same is true of the field strength, and hence the heat production varies inversely as the fourth power of the distance. On this assumption table 1 was calculated.

TABLE 1. — *The Radii and Masses of That Portion of Homogeneous Tissue Receiving Various Percentages of the Entire Delivered Energy.*

Diameter of Electrode (cm)	Radius of Tissue (cm) Receiving			Mass of Tissue (Kg) Receiving: Tissue (cm) Receiving:		
	25%	50%	75%	25%	50%	75%
4	2.7	4.0	8.0	.046	.24	2.1
6	4.0	6.0	12.0	.15	.76	6.8

This table shows for various sized spherical electrodes embedded in an infinite mass of homogeneous tissue, the radii and masses of that portion which receives twenty-five per cent, fifty per cent, and seventy-five per cent of the entire delivered energy. It is seen that half of the heat is produced about the internal electrode, within a mass of tissue, the radius of which equals the diameter of the electrode. Three-fourths of the heat is produced within a radius twice the diameter of the electrode.

The high efficiency of this method which uses an internal electrode, may also be shown in another way. In table 2 are given the temperatures which theoretically would be obtained under the same artificial assumption as we have previously adopted, at various distances from the electrode surface. The amount of energy upon which the table is based is that given by 20 watts for twenty minutes, as referred to in the preceding footnote. This amount of energy under the same favorable artificial conditions when given with other methods (belts, cuffs or plates) would not concentrate sufficiently to produce any appreciable elevation.

TABLE 2.—*Temperature Rise by Electrodes of Different Diameters at Various Distances from Surface.*

Distance from Surface of Electrode (cm)	Temperature Rise Diameter of Electrode (cm)	
	4	6
1	21.0° F.	9.8° F.
2	6.6° F.	4.0° F.
3	2.7° F.	1.9° F.
4	1.3° F.	1.1° F.
5	0.70° F.	0.62° F.

The high temperatures indicated near the electrode are, of course, never obtained, since heat conduction and blood circulation cause an equalization, so that in clinical cases the actual temperatures produced near the electrode will be lower than indicated in the table, while those produced at distances from the electrode will tend to be higher than tabulated. The non-spherical shape of actual electrodes also leads to such equalization. The proof of these statements is the observed fact that burns were not produced under treatment conditions. If this explanation is correct, the very high rises in temperature tabulated in table 2 should be observed in an inanimate phantom. An experiment was performed using a phantom of flour dough, the results of which confirmed in all essentials the calculated conclusions. The rise was very high at the surface of the electrode, and when after prolonged exposure the latter had been surrounded by a layer of brown toast 1 cm thick, the dough 3 cm from the electrode was still in its original consistency. At a distance of 10 cm from the electrode there was no appreciable rise of temperature.

Fortunately, we are in a position to insert electrodes into the orifices of the female pelvis. The conditions of treatment are of course considerably different from the hypothetical cases to which the tables apply, but these differences are not significant enough to disturb the basic relationship.

In conventional diathermy these relationships have long been known, at least in a qualitative way. It has, however, not been generally realized that these considerations could be applied to short and ultrashort wave treatments.

Considerable ingenuity has been expended in the past by numerous workers on the problem of producing an electrode which could be inserted into a body cavity and connected to a short or ultrashort wave apparatus. Many investigators have considered this problem and for some reason have always felt it necessary to incorporate in the electrode, "air spacing." These efforts, in our opinion, have been misdirected. The air space which has been found necessary in order to deliver energy from a high frequency oscillator to the body is required solely to provide the proper conditions for the operation of the high frequency generator, and has no connection whatever in this case with the distribution of the energy in the body. If anything, the various suggested schemes for air spaced electrodes have had deleterious effects upon the distribution, for reasons which we need not discuss here.

It is perfectly proper to arrange matters so that contact metal electrodes may be used, by placing the air space required by most available apparatus outside the electrode in the form of an auxiliary condenser. Because of the manner of propagation of high frequency currents a similar effect may also be obtained by a readjustment of the length of cords, omitting the condenser entirely. The theoretic calculation of the optimum cord length or the value and position in the circuit of the condenser, if one is used, is impractical, since all the variables involved are never completely known and are difficult to measure. Trial and error remains the easiest and quickest method for the determination of these quantities. Once these conditions have been established with a particular equipment and electrode set-up, they need not be redetermined for each patient.

The measurement of tissue temperatures with ordinary mercury thermometers while the short wave field is being applied, is not objectionable. In the past two major objections have been raised, first, that the mercury will distort the field and concentrate it so as to cause a local rise at the thermometer, and second, that the glass itself may heat in the field. Both of these objections appear to us to lack validity. The first fails because the dielectric constant of tissue is so high that the impedance of a path through the thermometer bulb is not smaller than that through an equivalent length of tissue.* The second objection falls because even if there were some heating of the glass of the thermometer, it would be very small because of the low field strength in tissue, and the normal heat exchange between the tissue and the thermometer would be well able to take care of it.

Experimental Data

Nine different apparatus were used in this work. Their wavelengths were stated to vary from six to eighteen meters. The output was said by the various manufacturers to vary from 150 to 500 watts. Patients referred from the gynecologic to the physical therapy department were treated by the various methods to be described.

The first method was that recommended by most manufacturers and described by almost all writers on short and ultrashort wave therapy. This

* If one calculates the capacitive impedance of a path through a thermometer bulb of one-half centimeter bore with glass walls (dielectric constant 5) 0.25 mm. thick, one finds an impedance more than fifty per cent greater than that of an equivalent mass of tissue.

method consists in the application of condenser plate electrodes opposite each other and over the exterior of the body. The anterior plate lies upon the lower abdomen, the posterior plate beneath the lower back or the buttocks. These condenser plates are separated from the patient's skin by a layer of non-conducting material (felt, cellu-cotton, folded towels or sponge rubber) of varying thickness. As a variant of this method, on a number of occasions the condenser plates were placed laterally over the patient's body. We also employed an abdominal belt electrode connected to one terminal of the short wave apparatus while the other terminal was connected to two cuffs, one placed about the middle of each thigh.

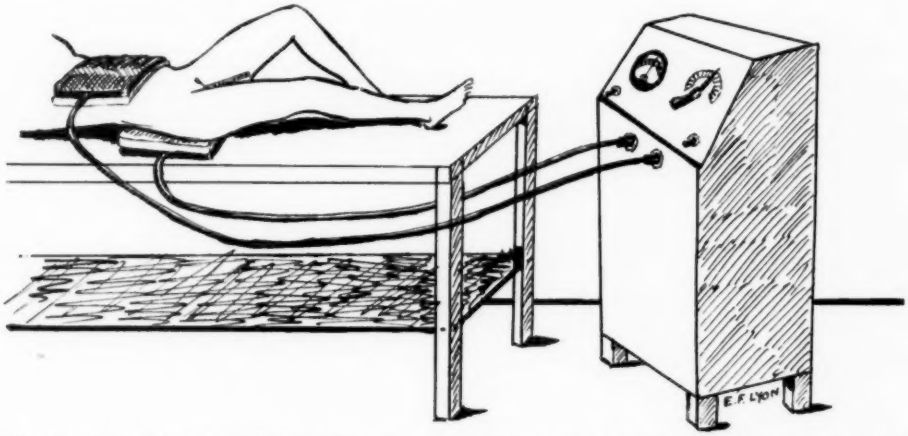

Fig. 1. — Application of condenser plates as usually advised for short wave treatment of the pelvis. Thermometer in vagina.

Internal temperature measurements throughout short and ultrashort wave applications by all of these methods showed only slight rises of temperature. In the rectum, vagina, cervix and bladder the highest temperature recorded during such treatments was 102.0 degrees F., and this only on one occasion. The patient was uncomfortable throughout this treatment because of excessive heating of the skin under the condenser plates. On other occasions temperatures between 100 and 100.8 degrees F. were the highest observed. Our findings therefore agree with those of Schultze-Rhonhof and Rech,[2] Nagelschmidt,[3] and Coulter and Osborne[4] who reported a relatively slight degree of internal heating under similar conditions.

TABLE 3.—*Temperatures During Pelvic Ultrashort Wave Treatment Using Anterior and Posterior Condenser Plates.*

Time (Min.)	Bladder	Cervix	Vagina	Rectum	Mouth	Pulse Rate
Start	100.0	99.8	99.2	99.5	98.0	80
5	100.0	100.0	99.5	98.8	98.0	80
10	100.2	100.0	99.6	100.0	98.6	80
15	100.2	100.0	99.6	100.0	98.6	80
20	100.2	100.0	99.5	100.0	98.6	80

Following the suggestion of Schliephake,[5] we have used a glass covered condenser electrode in the vagina. This electrode was connected to one terminal of the short wave generator and the other terminal to a condenser plate over the lower abdomen, or to a belt electrode about the waist of the patient. The highest internal temperature observed following treatment with this type of electrode was 105.4 degrees F. as measured by a thermometer inserted into the rectum immediately after turning off the apparatus and without removing the vaginal electrode. This temperature was recorded at

the end of a fifteen-minute treatment, most uncomfortable for the patient because of a burning sensation experienced in and about the vagina. In other treatments, when the current strength was reduced so as to make the treatment comfortable for the patient, rectal temperatures between 100.5 and 103.5 degree F. were obtained by this method. We have observed vaginal burns in two patients treated with this electrode.

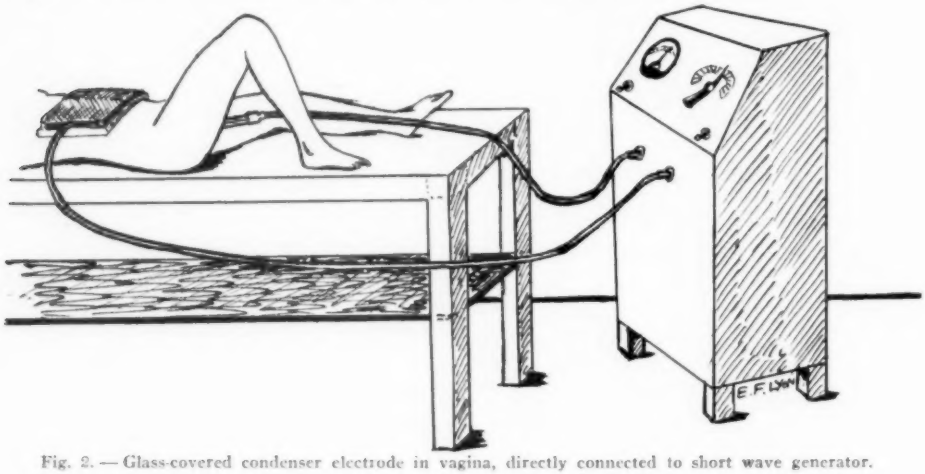

Fig. 2. — Glass-covered condenser electrode in vagina, directly connected to short wave generator.

When this work was initiated by us, certain manufacturers of short wave apparatus advised against the use of bare metal vaginal electrodes for short wave or ultrashort wave treatments. At the advice of our physicist, Mr. Myron Schwarzschild, we experimented with bare metal vaginal electrodes connected to one terminal of the short wave apparatus by a device known as a pick-up plate. This device was utilized by Mr. Schwarzschild several years ago[6, 7] in connection with the thirty-meter short wave Radiotherm. A metal plate is placed parallel to one of the condenser plates and separated from it by an air space. This metal plate is connected directly to the metal electrode within the body cavity. In adapting this method to various apparatus it was found that the relative size and spacing of the condenser plate and pick-up plate and the length of the cable from this plate to the internal electrode had to be varied with each apparatus to obtain the greatest output.

A simplification of this device was obtained by the use of a variable con-

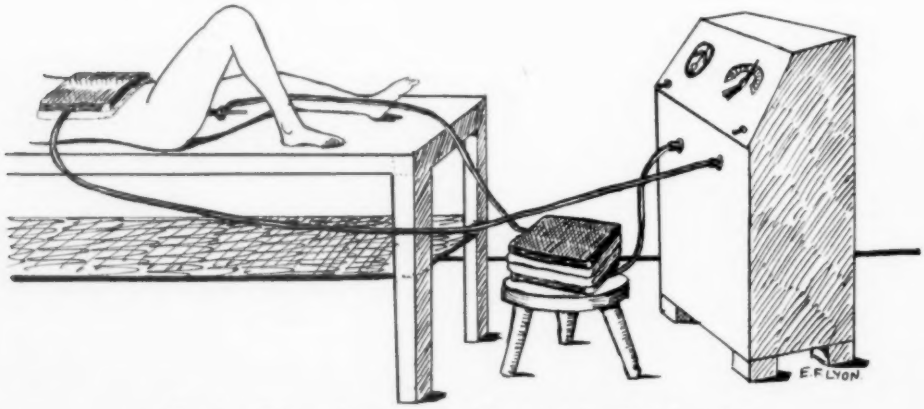

Fig. 3. — Pick-up plate technic, with bare metal vaginal electrode.

denser. Delherm and Fainsilber[5] have reported the interposition of a condenser between the short wave generator and a metal electrode in the vagina or rectum. The use of a condenser substitutes the mere turning of a knob for an experimental variation in the size and spacing of condenser and pick-up plates.

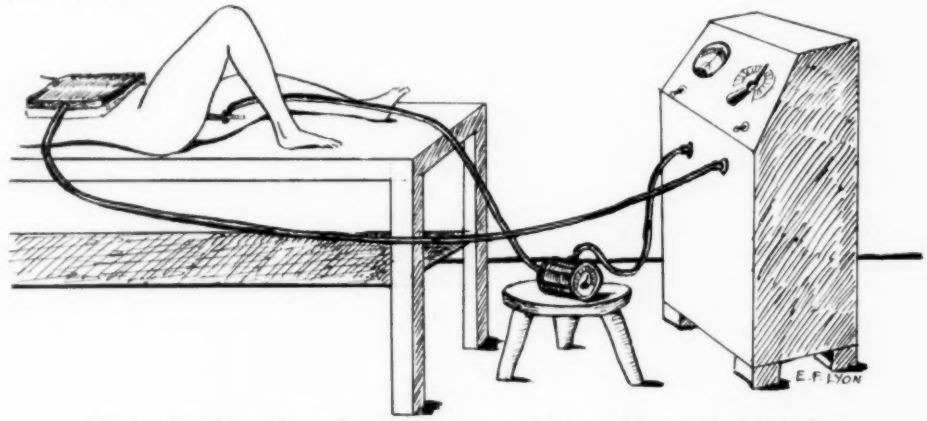

Fig. 4. — Variable condenser between short wave generator and bare vaginal electrode.

Many treatments were administered by us with each of these two devices, together with a metal electrode in the vagina. It was found that patients were very comfortable throughout these treatments and that high internal temperatures were produced. The comfort of patients so treated was in striking contrast to the marked discomfort during treatment with glass covered vaginal electrodes.

With both the pick-up plate and the condenser arrangement there is a loss of energy which necessitates the employment of generators of large output in order to obtain substantial internal temperature elevations. It was suggested by our physicist that it should be possible to find a definite length of cable from the short or ultrashort wave apparatus to the metal electrode, with the use of which a high degree of internal heating could be produced, eliminating the energy losses inherent in the two previous methods. Before using a direct connection each apparatus was examined as to the safety of such application. With some machines the possibility exists of putting the patient into direct circuit in the event of a breakdown of a condenser.

In experimenting with one six meter apparatus, for example, it was

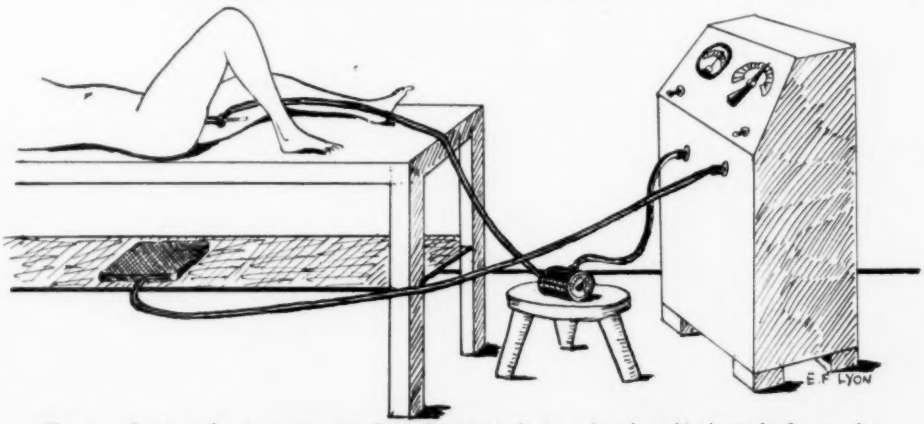

Fig. 5. — Same as fig. 4, except that dispersive electrode is under the table instead of over the patient's abdomen.

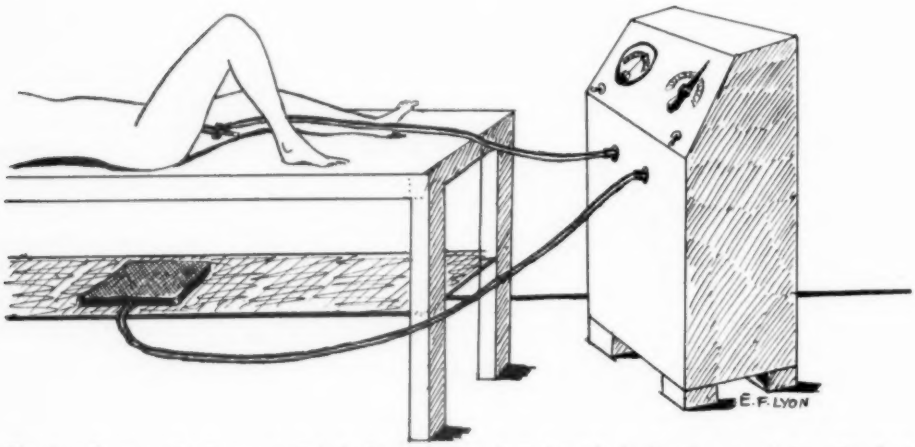

Fig. 6. — Same as fig. 5, except that the bare metal vaginal electrode is directly connected to the short wave apparatus by a cable of specific length.

found that a twenty-three inch cord connected directly to the active electrode made possible the greatest rise of internal temperature.

Frequently quoted in the literature on short and ultrashort wave therapy is the statement that mercury thermometers cannot be used for temperature measurement in the short and ultrashort wave field. A proof of this assertion is ascribed to Pätzold[9]. In Pätzold's experiment with the thermometer bulbs surrounded by an air space, the mercury thermometer recorded deceptively high temperatures in the condenser field because of overheating within the thermometer. When, however, the mercury thermometer was in contact with materials of a dielectric constant similar to that of human tissues, the temperature was accurately recorded by it in the field. It seemed to us that when a thermometer is inserted into the rectum, the vagina being distended by an electrode, the rectal walls are approximated by the mass of the electrode in the vagina, and the thermometer bulb is in contact with mucous membrane on all sides. A thermometer in the bladder is also not in contact with air, but with mucous membrane and urine. For these reasons it seemed that temperature determinations similar to those which we had previously made during diathermy treatment[10] could be accurately made also in the short wave field.

To check the accuracy of the internal temperatures recorded during treatment, we made a series of determinations immediately after turning off the short wave generator. Thermometers which had been kept in water at 100 degrees F. were then quickly inserted into the various orifices and into the channel within the vaginal electrode. The temperatures so recorded were sometimes almost identical with those previously obtained before shutting off the apparatus, and always within a degree or a degree and one-half. These observations confirmed our belief that relatively accurate temperature readings are obtainable with mercury thermometers in the tissues in the short and ultrashort wave field. This may not be true for measurements with alcohol thermometers.[9]

The use of greater air spacing than is commonly employed by placing the external condenser pad under the treatment table,[11] was a great convenience in some of our work.

Vaginal Electrode Temperatures

The vaginal electrodes which we used[10, 12] are of metal, with an insulated stem, and are provided with a thermometer, the bulb of which penetrates

into a channel in the bare metal portion of the electrode. The scale of the electrode thermometer can be observed through a window in the insulated stem, or else it projects beyond the stem. The electrode thermometer does not necessarily represent the exact temperature at any particular point. Being of solid metal, except for the thermometer channel, the active electrode has an appreciable mass and heat capacity and therefore takes a little time to heat up, or to cool.

Within a minute or two after the short wave generator is turned on, the temperature recorded by the thermometer in the vaginal electrode begins to rise. This rise continues, reaching a peak in 5 to 15 minutes, an average of 11 minutes. The highest vaginal temperature so recorded during each of 210 pelvic short and ultrashort wave treatments utilizing a vaginal electrode, varied between 101.6 and 111, averaging 107.5 degrees F.

As treatment continues, the vaginal temperature does not remain at the peak which it has attained, but soon drops to a lower level. If the output of the apparatus is increased, a second rise in vaginal temperature will occur, followed by another drop. Naturally, the vaginal temperature is now maintained at a somewhat higher level as a result of the increased energy used. At the end of these treatments of 15 minutes duration the vaginal temperature averaged 106.3 degrees F. It was found that with the use of greater quantities of energy the peak temperature was higher, was reached more rapidly and was usually followed by a little greater drop from the peak level.

Rectal Temperatures with Vaginal Electrode. — In measuring rectal temperatures during, or immediately after treatments in which a vaginal electrode was used, the proximity of the bulb of the rectal thermometer to the vaginal electrode was found to be of importance. With two thermometers simultaneously in the rectum at various depths during treatments, the thermometer inserted to a depth of 3 inches recorded higher temperatures than the one inserted 1½ inches. It was found convenient as a routine to insert rectal and bladder thermometers 3 inches, which was most likely to bring the thermometer bulb close to the vaginal electrode, whatever the depth of the vagina. The temperatures registered by these thermometers and by the vaginal electrode thermometer, were recorded at intervals throughout treatment. When the short or ultrashort wave generator is turned on, the rectal temperature rises, reaching an average peak of 106.2 degrees F. in 12 minutes.

Cervical Temperatures with Vaginal Electrode. — Cervical temperatures were measured by means of a long mercury thermometer, its bulb entirely within the cervical canal and its shaft projecting outside the introitus so that the scale could be easily read. At the end of treatment a speculum was inserted to make sure that the thermometer bulb still was within the cervical canal. If dislodged so that the bulb was in contact with the vaginal electrode, the temperatures recorded were obviously not cervical temperatures.

During 28 treatments the cervical temperature closely followed the vaginal, reaching its maximum averaging 106.8 degrees F. in 11 minutes. In 16 of the 28 cases there was a drop from the peak temperature by the end of the 15-minute treatment, averaging 1.0 degrees F.

Bladder Temperatures with Vaginal Electrode. — Patients were asked to void a short time before each treatment. Bladder temperatures were measured by means of a long thermometer inserted at a distance of 3 inches.

The bladder temperature was recorded during 58 pelvic short wave treatments of 15 minutes duration. The peak bladder temperature varied from 102.4 to 110, averaging 106 degrees F., and was attained in the average

time of 13 minutes. The average bladder temperature at the end of the 15-minute treatment was still 106 degrees F.

TABLE 4.—*Average Temperatures Produced by 15 Minute Vaginal Short Wave Treatments.*

	No. of Treatments	When Peak was Reached (min.)	Peak Temp.(°F.)	Terminal Temp.(°F.)
Vaginal	68	11	107.5	106.3
Rectal	58	12	106.2	106.1
Bladder	58	13	106.0	106.0
Cervical	28	11	106.8	106.2

Table 4 shows that the temperatures of the vagina, cervix, rectum and bladder reach a maximum at about the same time (in 11 to 13 minutes), the vaginal peak a little higher than the others, but that at the end of the 15-minute treatments the temperature levels are only a few tenths of a degree apart. At the end of 30-minute treatments, the vaginal temperature averaged 105.8, rectal temperature 105.7, bladder temperature 106.8 and cervical temperature 106 degrees F. This higher bladder temperature may be associated with the increasing temperature of the bladder urine.

Heating of Urine in Bladder

The temperature of the urine voided after 120 pelvic treatments was measured. When the generator was turned off at the end of each treatment, the electrodes were at once removed and the patient instructed to void into a paper cup containing a clinical thermometer. This method of measuring urine temperatures was found useful in a previous study of pelvic heating by diathermy.[10]

Urine temperatures were measured following six "transpelvic" short wave treatments administered by a number of different technics. The condenser plates were placed externally about the pelvis in various ways, without the use of an internal (vaginal or rectal) electrode. Treatments lasted 15 to 20 minutes. The urine temperatures following these treatments varied between 98.6 and 100, averaging 99.3 degrees F.

Urine temperatures were also measured following 114 pelvic treatments administered with the aid of a metal electrode in the vagina. The second electrode was most often a condenser plate over the lower abdomen. In a few instances an insulated belt about the waist of the patient was used, or a condenser plate placed on a shelf under the treatment table.

The temperatures of the urines voided following these 114 vaginal short wave treatments varied between 99 and 106.8, averaging 103.3 degrees F. The true values were probably a degree higher because of the cooling incidental to the method of measuring urine temperatures which was employed.

The degree of heating of the urine varied with the vaginal temperature elevation and the duration of the treatment. Urine temperatures after 45-minute treatments averaged 104.2, and following 60-minute treatments 105.3 degrees F.

We could demonstrate no variation in the heating of the bladder urine depending upon the wavelength of the apparatus. The use of apparatus of varying output and with different technics of application would be likely to mask any effect of specific wavelength.

It was noticed that specimens voided after treatment were usually paler and of a lower specific gravity than those voided before.

Mouth Temperature and Pulse Rate

Mouth temperature and pulse rate were recorded immediately before and after 88 pelvic treatments. The patient having undressed and placed

herself upon the treatment table, the electrodes were applied, mouth temperature, pulse and other observations made, and the treatment started. This work was done in a busy clinic and it was usually not feasible to allow a preliminary period of rest on the treatment table. Our pre-treatment observations of the pulse often were made before the heart had had time to slow down as a result of the patient's resting in a horizontal position after the activity of undressing and mounting the table. It is probable that in some cases we missed a slight drop in mouth temperature resulting from the partial disrobement of the patient and the substitution of a drape sheet for part of her clothing.

Eighty of the 88 patients whose pulse and mouth temperatures were studied, were treated by the vaginal electrode technic. Treatment time varied from 10 to 60 minutes, but three-quarters of the treatments were of 15 minutes duration or less.

Mouth Temperature Changes.— After 10-minute treatments there was an elevation of mouth temperature in half of the cases, averaging 0.5 degree F. Following 20-minute treatments an elevation occurred in 85 per cent of the cases, averaging 0.6 degree F. Following the 45- and 60-minute treatments, there was an elevation of mouth temperature in every case, averaging 0.7 degree at the end of 45 minutes, and 0.8 degree following the 60-minute treatments.

Pulse Rate Changes. — After treatments of 10 or 15 minutes duration, two-thirds of the patients had an elevation of pulse rate, averaging 6 beats per minute. Treatments of 25-minute duration or longer were practically always followed by an elevation of the pulse, which averaged 10 beats per minute at the end of a 25-minute period, 12 beats at the end of 45 minutes and 14 beats at the end of an hour.

Mouth Temperature and Pulse Following "Transpelvic" Short Wave. — Following 8 pelvic short or ultrashort wave treatments during which only external condenser plates were used, the mouth temperature was elevated in half of the cases. This elevation averaged 0.6 degree F. These treatments varied from 15 to 20 minutes in duration. The pulse was unchanged after most of these treatments.

Summary

1. On a theoretic and experimental basis it is shown that the cavity electrode is far superior to other electrode arrangements for the production of high local temperature elevations in the pelvis.

2. Air spacing is not necessary with such an electrode if appropriate minor changes are made in the connecting devices.

3. Temperatures may be measured with mercury thermometers in the tissue during the application of short or ultrashort wave treatment.*

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* We are grateful to Dr. I. C. Rubin, gynecologist to the Beth Israel Hospital, for his interest in this work. Thanks are due to the various manufacturers who placed their apparatus at our disposal.

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CLINICAL COMPARISON BETWEEN DIATHERMY AND SHORT WAVE DIATHERMY *

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Every new discovery in medicine brings along its wave of enthusiastic reports of results in a multiplicity of conditions. There are always some men ready to rush into print or onto the lecture platform with premature conclusions drawn from their all too short or too one sided observations. The recent introduction of short wave diathermy, incorrectly designated as short wave therapy, has again vividly illustrated this general tendency, at least so far as our experience with it in the United States, is concerned. Its introduction here came primarily as a move by manufacturers who saw the commercial possibilities of exploitation. As short wave apparatus can be built fairly easily and inexpensively, small concerns having no experience with electro-medical apparatus, rushed into the promising new field. No wonder that their sales propaganda was unscrupulous and, as a result, many inexperienced physicians have been saddled with unstandardized apparatus, often of flimsy make and of dangerous possibilities. This state of affairs was further aggravated by uncritical publications by men who have had either no experience in general physical therapy or who are entirely test-tube experts and whose conclusions have very little if any practical value.

Fortunately the situation is improving. Well controlled research and clinical work have been carried on for some time by competent men. Their publications have cleared up a number of doubtful points and disproved some unwarranted claims. It will necessarily take several years of patient clinical research and technical developmental work before the definite place of this newer form of high frequency energy becomes established. It is with this understanding that I am presenting at this time, a comparison between the relative merits of conventional diathermy and short wave diathermy on the basis of personal experience during the past two and a half years and of reports of competent investigators.

* Read before the Sixth International Congress of Physical Medicine, London, May 13, 1936.

The practical questions I am endeavoring to answer are: (1) the physical relation between conventional and short wave diathermy and the relative effects of the two methods; (2) the relative dangers of the two methods, and (3) the relative advantages, if any, of the new method over the older one.

Physical Relation and Effects

Short wave diathermy with its wavelengths from 30 to 3 meters stands in close relation to the comparatively shorter wavelengths of infrared radiation on one side and to the longer, 300 meter waves on conventional diathermy on the other side. In penetrative power through tissues it exceeds both. Its primary physical effect is that of heat generation and this explains adequately its action. Specific electric vibratory effects for ultrashort waves are claimed by some authors, but they are hard to prove, just as it was not possible to prove conclusively and specific high frequency effects for conventional diathermy. As there is no essential difference between the primary physical effects of conventional and short wave diathermy, we cannot expect much difference in their physiologic and therapeutic effects. Heating by conventional diathermy occurs mainly through conductive resistance of the tissues, while in short wave there is both conductive resistance and hysteresis or dielectric heating. This may account for more uniform heating in depth and less heating in the skin, but the essential effect is still nothing but heating. Clinical experience and not experiments on inorganic media and on dead tissue will decide for which conditions the short wave form of heating is more preferable.

It may also be stated at this time that claims for "selective" heating by short waves in laboratory experiments have not been corroborated in the living human organism and do not hold out hope for any practical therapeutic value.

There appears to be a difference in clinical effects of short wave (from 12 to 30) and ultrashort wave diathermy (below 12 meters). The latter seems to exert a pain-relieving effect on acute inflammatory conditions, and it is claimed that it cuts short purulent skin infections and generally brings suppurative conditions to quicker resolution. While this action has been much emphasized as a specific effect, competent observers have failed to prove any other than heating effects by ultrashort waves. It is well known to all experienced physical therapists that other forms of mild heating, such as hot poultices and, in recent years, luminous heating, when applied efficiently produce similar resolving and sedative effects so far as purulent skin conditions are concerned.

Relative Dangers

The earlier claim by some manufacturers that short wave diathermy is safe and cannot cause burns is preposterous. Burns have occurred under electrodes due to undue current concentration or to over-heating and conflagration of the rubber insulation or the electrode cables placed on metallic parts.

In spite of these reports it seems reasonably certain that short wave diathermy is comparatively safer than conventional diathermy. The skin does not get as hot and, the electrodes being insulated, there is no danger of an immediate burn when electrodes are lifted off. There *is* danger due to a condenser effect on excessive perspiration under the electrodes and, hence, it is imperative to place absorbent material over the skin; furthermore, no flexible metal electrode should ever be used without the interposition of a

towel or felt pad. Animal experiments have shown that it is possible, by short waves, to cause coagulation in the depth without any burn on the surface, thus the possibility of deep destruction by excessive heating cannot be denied.

Relative Advantages and Disadvantages

The relative advantages of the two methods can be considered from the standpoint of (a) convenience, (b) efficiency, (c) ultimate results. In all these considerations it must be taken for granted that apparatus of equal relative efficiency is being employed.

From the standpoint of convenience, short wave diathermy is undoubtedly superior to the older method because the application of condenser electrodes is quicker and simpler; furthermore, treatment can be administered with due care over curved surfaces, over wounds and through plaster casts where it would be impossible to apply diathermy. The new method of heating an extremity or, part of it, efficiently, by winding about a coil or cable activated from a short wave apparatus is also a marked convenience. For general body heating this coil has also proven quite useful.

The fact that, with short wave diathermy, treatments can be administered on the fully or partly clothed body is an advantage in the hands of the expert; in the hands of the beginner, however, it is likely to breed carelessness and neglect of the elementary rule of any electrical treatment, i. e. close inspection of the parts before and after treatment.

From the standpoint of efficiency, conventional diathermy has the great advantage that it allows in local treatment a fair estimate of minimum and maximum dosage through the use of the milliammeter and that the same dosage can be repeated at subsequent treatments. In short wave treatments the skin sensation of the patient is the only guide for the regulation of the current input, as the tuning device only shows that under the given technic a maximum resonance is present between the treatment and the oscillating circuits. There is no proof that maximum dosage is passing and there is no safeguard against burning of the skin or possible damage to deeper parts in case of deficient skin sensation. This crude method of dosage regulation is the greatest present drawback of short wave therapy and until it is satisfactorily remedied, many local treatments will be adminisitered on the principle of the hit or miss method only. In short wave fever treatments the rise of temperature is a reliable guide.

It is a fact that many patients like the smooth form of heating and all absence of faradic sensation by short wave treatment. On the other hand, I have heard many intelligent patients who have had diathermy treatments before, express doubt whether the "short waves" were as effective as their diathermy treatments. It is more than likely that many of the beneficial effects of diathermy originate from reflex action through the skin and the relative lack of skin stimulation undoubtedly plays a rôle in the different sensory effects of short wave treatments.

For general treatments, notably artificial fever treatments, short wave diathermy from suitable apparatus is much superior to conventional diathermy because it allows easy handling of the patient, avoids constricting strappings and the danger of burns by plate contact.

From the standpoint of ultimate results, at present there is no proof that short wave diathermy gives better results in the conditions in which diathermy is usually of value. An effort to tabulate similar conditions treated by diathermy and short wave diathermy in the physical therapy department of the New York Polyclinic Medical School and Hospital and compare

the number of treatments needed for recovery in each, shows almost the same average number for each. In my office work for the average number of patients who get along well on short wave diathermy, there is a corresponding number getting on just as well and just as quickly on conventional diathermy.

I believe that we have in short wave therapy, a new, flexible and fairly simple form of deep heat treatment which compares favorably with conventional diathermy. I do not think that it will essentially change the treatment of any condition in which diathermy has been applied heretofore. In due time we will undoubtedly learn under what conditions the newer form of treatment is preferable to the older one but, not until the regulation of dosage has become more clear cut and we are able to determine definitely the amount of heat effect in the depth.

Conclusions

1. Short wave diathermy and conventional diathermy have similar physical and physiologic effects. Ultrashort wave diathermy may exert less surface heating and this may explain better tolerance in acute inflammatory conditions.

2. Short wave diathermy is a simpler and safer method, but its dosage regulation is crude.

3. The clinical results with the two methods are alike in cases in which either method can be conveniently applied. Further extended clinical and laboratory observation will determine in which conditions the new method may be preferable.

1100 Park Avenue.

British Scientist Attacks Racial Superiority Theory

Two widely held biological opinions which are claimed to be the basis of the present policy of one European nation are attacked by Prof. J. B. S. Haldane of the University of London.

Sterilization of the unfit is not necessary for national hygiene, and the evidence that some races are superior to others is rather weak, Prof. Haldane pointed out in his Halley Stewart lecture.

As far as improving national hygiene by decreasing the number of unfit, other measures than sterilization are available in all cases, Prof. Haldane observed, mentioning as alternatives chastity or birth control for mentally normal persons and segregation for defectives.

"It is doubtful whether sterilization of all mental defectives would reduce the number of the next generation by 15 per cent," Dr. Haldane said, referring to one of the arguments of those who favor sterilization of the unfit.

Prof. Haldane has analyzed five classes of human abnormalities that are determined genetically, or in the popular phrase, are inherited. His analysis shows that sterilization would be very effective in the case of such abnormalities as lobster claw, Huntington's chorea and similar conditions which may all be determined by dominant genes. Sterilization would be moderately or slightly effective in other conditions associated with dominant or sex-linked genes or the cooperation of several genes. It would, however, be totally ineffective in conditions associated with inbreeding, as in the marriage of cousins.

Discussing the theory of racial superiority, Prof. Haldane called attention to the fact that innate psychological characteristics of races overlap. Among the so-called races of Europe outside the Arctic there is also overlapping of physical characteristics.

Some facts, he said, support the theory that racial crossings for humans as well as other animals are advantageous in the first generation but harmful in later ones. — *Science News Letter.*

MODERN TECHNIC IN HYDROTHERAPY *

HANS J. BEHREND, M.D.

NEW YORK

The modern literature presents a diversity of opinions regarding the indications, effectiveness and technics of hydrotherapy. Various applications are suggested for one and the same disease, the indications are varied, and contraindications have been claimed for certain affections, notably cardiovascular disease.

The scientific explanation of hydrotherapeutic applications is unsatisfactory in many directions despite thorough research. This has for some decades developed the scientific foundation and logical justification of this method of treatment, used empirically by physicians since ancient times.

The physiologic effects of cold and hot applications have been studied critically with regard to their action on respiration, circulation, metabolism, composition of blood, and the like. As far as the circulation of blood is concerned two laws are now generally recognized. One is Ottfried Mueller's law of the consensual reaction, in which the skin is considered as a unit. If any stimulus touches a sufficiently large part of it, the whole skin-organ reacts homogenously. The second is the law of Dastre-Morat, which divides the body in a peripheral and a central region. The skin and the striped muscles are considered as the periphery and the internal organs including the intestines, liver, and the like, as the central region. These two regions are said to be in a balanced relationship, which means that large amounts of blood could be moved from the periphery to the center and vice versa. However, it was shown that there are exceptions to the rule and that this law could not be regarded as valid in the manner enunciated. It was found that the blood vessels of the kidney, the intestines, the spleen and the brain were in parallel reaction to those of the skin. For instance any application that causes a contraction of the blood vessels of the skin also leads to a contraction of the blood vessels say, of the kidneys or the brain. This conception led to new aspects in hydrotherapy according to which some of its technic has been changed or will be changed more and more in the near future. It is my desire to present a review of modernized technic of hydrotherapeutic applications.

Partial Bath

The first measure to be considered is the partial bath of increasing temperature. It may be given for the arm, foot, hip or as a half bath. For the arm bath any large basin may be used. Special arm tubs have been constructed with a double bottom and double wall. The inner layer is perforated at the bottom so that the hot water running down between the layers of the double wall enters the bath from the bottom without touching the arm. The patient is wrapped first in a sheet from the feet to the armpits and then in a blanket, the arms remaining free. Then the arms are placed in the tub filled with water at 98 degrees F. Now hot water is slowly added until, after about 10 to 15 minutes, it reaches a temperature of 110-120 degrees F. Usually after 5 to 6 minutes, sometimes later, perspiration is noticed. The duration of the bath depends on the individual case. It may be discontinued as soon as sweating occurs, or it may be continued up to

* From the Physical Therapy Department of the Hospital for Joint Diseases, New York City.
* Read before the New York Physical Therapy Society, New York, January 8, 1936.

about 30 minutes. Observation of the pulse and respiration serves as a useful guide. If palpitation, nausea, dyspnea are noticed, the application should be stopped immediately. After the bath the patient rests on a bed lightly covered to cool off gradually. No after treatment is required.

This simple treatment is by no means new. Schweninger first used these baths. Later Hauffe investigated the action of these baths and built up a new theory of the mechanics of circulation which is not generally accepted. However, no one has yet been able to refute these theories, because the good effects produced by the bath can be and have been confirmed by anyone who applies them. Recently published textbooks on hydrotherapy show that Hauffe's ideas are beginning to influence the opinion of men outstanding in the field.

There always has been appreciated a contrast action of hot and cold applications. Hot applications lead to dilatation of the blood vessels, shown as redness of the skin; cold applications to a constriction, followed, if the application is short, by a "reaction" that also produces redness of the skin.

Hauffe's investigations with the plethysmograph have shown that redness of the skin is by no means a sign of dilatation of the more deeply located arteries. Reddening of the skin in his opinion affects merely the superficial capillaries, hence no conclusions can be drawn from them as to the larger and deeper vessels. His plethysmographic curves show that after any cold application (douche or partial bath) and after a hot application (douche or steam spray) the affected area of the skin is reddened. On the other hand, the curve of the volume of, say, the arm is diminished, which he ascribes to contraction of the larger blood vessels (fig. 1).

Fig. 1. — Vapor bath.

Hauffe's experiments have shown that all sudden thermal stimuli, whether of heat or cold, cause contraction, stimuli of gradually increasing heat produce dilatation of the peripheral blood vessels. The difference in effect is explained as depending on the strength of the stimulus applied in unit time, that is to say, the number of heat units and not the degree of temperature, is the determining factor.

A brief summary of the vascular effects of the partial baths has been published by the writer in the "Archives of Hydrology" of January, 1934. This summary shows that the partial baths of increasing temperature give a true dilatation of all peripheral blood vessels, and are obviously indicated in all cases where the peripheral circulation seems to be affected. We for-

merly feared to treat patients suffering from high blood pressure, from attacks of angina pectoris and from pneumonia with hot baths because of the danger of heart failure and collapse. It was frequently observed that pains accompanying peripheral vascular disorders on an arteriosclerotic or thromboangiitis obliterans basis became worse after a hot bath. We are no longer afraid to treat hypertension, angina pectoris, myocarditis, pneumonia, peripheral arteriosclerotic disorders, or Buerger's disease with high temperatures, since we know that to avoid all untoward effects we need but increase the temperature very slowly. We then notice a fall of blood pressure and a soothing effect on the anginal attacks and on the pain in thromboangiitis obliterans. Though we can by no means claim to cure these conditions, a course of treatment produces definite symptomatic relief.

Arthritis

These partial baths have also stood the test in the treatment of chronic arthritis, mainly of rheumatoid arthritis, with which cardiovascular changes are associated very frequently and also of osteoarthritis, particularly when associated with hypertension. In these cases we produce precisely the desired effects: perspiration and improved circulation in the depth of the extremities and joints.

Since we have become familiar with these treatments and their explanation, we have abandoned the older technic of contrast baths. We must discard the old conception that in contrast baths heat dilates and cold constricts and that the blood vessels are given a kind of exercise. As it has been shown that both extreme temperatures lead to a constriction of the more deeply located arteries, we are not surprised that patients with peripheral vascular disorders are not benefited. We have also abandoned the technic of placing a cold compress on the head or heart region of a patient sitting in a cabinet bath. Cold compresses were applied with the desire to avoid congestion in the head. It is true that abrupt intense heat, such as experienced in the cabinet bath, where the patient has to absorb many heat units, causes a congestion back to the central region. To relieve such a congestion one should apply a warm compress to the head, which will cause the suddenly constricted blood vessels to dilate. As a result the area so treated produces a dissipation of excess heat. In this connection it is suggested that contrast temperatures be avoided with the application of the Scotch douche, except in patients free from cardiovascular trouble.

From what has been said one should not gain the impression that all our knowledge of the older conceptions and technics should be discarded. On the contrary hydrotherapy in all its ramifications still holds good, so far as certain older observations are concerned.

If cold or hot temperatures are applied to the body surface we invariably have to deal with two effects, namely, the specific effect of the temperature and the irritative effect of the application. Both are linked together as explained above, and sometimes, as in the application of heat, the irritative effect prevents the desired specific effect.

We are very frequently called upon to treat patients with a normal vascular system in whom we wish to produce reactions similar to those caused by nonspecific protein shock therapy. We have to deal with pathologic disturbances of the body and we purposely superimpose a further disturbance. We then expect a response which leads to improvement. For this purpose we use the strong pressure of the Scotch douche to treat rheumatic disorders and also the more soothing and healing effect of the steam douche. The steam jet is an apparatus in which steam at suitable temperature flows from a nozzle of a movable hose. The pressure of the steam

varies from three to four pounds and the temperature where it touches the skin was shown by measure to be 100 to 102 degrees F. There is a contrivance to prevent any condensing waterdrops from touching the skin. The steam jet has been successfully used in the treatment of rheumatic disease. Massage can be given simultaneously.

Indolent Wounds

The healing effect on indolent wounds merits consideration. A vigorous and nourishing hyperemia produced by the steam and the temperature of 100-102 degrees F. is so mild that we also must assume a production of hyperemia in the deeper tissues, for it is known that moist warm applications have a deeper effect than dry ones. This quality of the steam combines with the mechanical action which the steam exercises when falling upon the skin and imparts a soothing sensation.

For two years we have treated in the hydrotherapy department of the Hospital for Joint Diseases indolent wounds which have resisted all other methods of treatment with satisfactory results. Old osteomyelitic skin lesions healed, as did arteriosclerotic gangrene of the toes. In the case of the latter we also combined the steam treatment with a preceding arm bath of increasing temperature.

While considering the applications of heat, the foam bath should be mentioned (fig. 2). It belongs according to its nature to the class of gas-water baths.

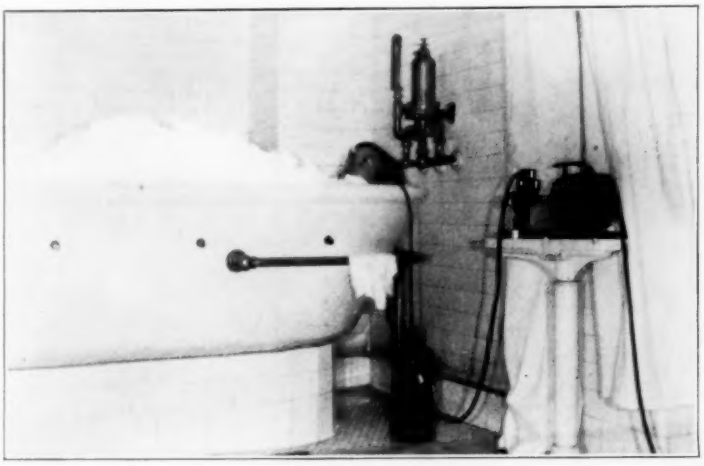

Fig. 2. — Foam bath.

An ordinary bathtub is filled with hot water to a depth of 4 inches. In the bottom of the bathtub is placed an air distributor consisting of perforated rubber tubing. This tubing is arranged in sections which are in a wooden frame. About one ounce of a saponine extract is added to the water and then air is driven into the water from an air pump attached to a small motor. In a few minutes the whole tub is filled with a fine foam. Not only plain water is suitable for producing the foam, but all sorts of chemical preparations can be added, such as salt, sulphur, pine extract, menthol, and the like, which combine with the water and make up the wall of each foam bubble. One of the characteristics of the foam is its low heat conductivity. The foam consists of air bubbles. Consolidated or stationary air is, as is well known, an excellent heat insulator. The foam keeps the heat for a long time. It is a mixture of 10 per cent water and 90 per cent air. The constant explosions of the myriads of foam bubbles produce an important stimulation

of the sensory nerve endings and influence the capillary circulation of the skin. The main feature of the bath is augmentation of sweat secretion, varying with each patient in amount and time. A fall of blood pressure is also observed. Foam baths are indicated in arthritis and other rheumatic disorders. They may be especially recommended for the treatment of the obese climateric woman with osteoarthritic symptoms and hypertension. Sweat cures given as foam baths are better tolerated by this group of patients than other baths, because of the comfort experienced while in a resting position. Foam baths are also used as an adjuvant for weight reduction with satisfactory results.

Mud (Fango di Battaglia) Baths

Finally another hydrotherapeutic application is important, not because of its novelty but because of its usefulness and simplicity. The use of Fango di Battaglia mud packs in the treatment of rheumatic and other conditions

Fig. 3. — Fango mud application in gynecologic conditions.

Fig. 4. — Fango mud application in affections of upper extremity.

is world famed (figs. 3-6). This mud has the added advantage of being supplied in powdered form. The labor required to break down the stone-like blocks is avoided. World famed also is the name of the Czechoslovakian spa Piestany, from which mud is exported in a dry form. It comes to us in the form of a cube or brick and contains the original mineral mud of the hot springs compressed and preserved by a special patented process that may be kept for years without losing the original therapeutic effect. The mud is prepared by first breaking up the large brick. The pieces are then placed in hot water and stirred until a proper consistency is obtained. The mass is then reheated on a stove. The mud is spread over the affected joint or other part of the body, and then covered with rubber sheeting or waxed paper. The joint is

Fig. 5. — Fango mud application in affections in lower extremity.

Fig. 6. — Local Fango mud application showing patient completely covered by blanket.

next wrapped in a sheet and finally enveloped in a thick blanket. The patient stays in the pack from 15 to 45 minutes. The mud is then removed and kept in a pail, as it can be used several times. Sometimes it has proved useful to have the steam douche follow the mud pack. The mud can be washed off easily. After the treatment the patient must rest for an hour or two. It should be mentioned that the mud may be used without cover during the time of application. A light cradle or an infrared lamp should then be used to keep the mud hot.

We here deal with a heat effect as the heat conductivity of the mud is low, and high degrees of temperature can be given, provided the vascular system is normal. The radioactivity and the sulphur content of the Piestany mud have also to be considered, and may be factors in producing good results.

Mud packs are indicated where we want to accelerate the absorption of exudates and of other materials foreign to the blood stream. An excessive absorption may lead to what results as a so-called bath reaction. The question whether or not such a reaction is desirable is still unanswered. In the Hospital for Joint Diseases, local mud packs have been used for the treatment of various rheumatic diseases of the joints. The results obtained are very satisfactory especially in osteoarthritis, where absorption of exudates has been noticed as well as relief of pain and improvement of impaired motion. Mud packs also have been used for the treatment of injuries including fractures, sprains and contusions, and also for postoperative treatment of joints to improve motion and relieve pain.

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THE STUDENT'S LIBRARY

ALLGEMEINE PHOTOCHEMIE. Ein Hand-Und Lehrbuch Für Studium und Forschung Für Mediziner, Biologen, Agrikultur-Chemischer, Botaniker USW. By *J. Plotnikow*, Dr. Phil., Dr. Chem. Ö. O. Professor und Direktor des Physik.—Chem. Instituts an der Technischen Fakultät der Universität zu Zagreb. Boards. Pp. 909 with 218 illustrations. Second, enlarged and completely rewritten edition. Price 28.50 RM. Berlin and Leipzig: Walter De Gruyter & Co., 1936.

Although contributions on photoradiation have been both diversified and voluminous, none has as quickly captivated the enthusiasm and attention of of the serious reader as the work under consideration. The present edition is a labor that unquestionably stands out as the most erudite and inclusive exposition on the nature and action of thermoradiant and ultraviolet energy presented in the space of a single but rather bulky volume. Intended as general text book photochemistry for medical and research students of such allied fields, as biology, botany, and the like, the listed contents cover perhaps a wider range of topics than is ordinarily discussed in books of a more specialized nature. Nevertheless the data is so intimately connected that both medical and technical students will here find information of related and independent interest vital to their special practices. As such it is encyclopedic in scope and full of scholarly detail. The contents are divided into four massive sections, each of which could well be considered as a special monograph on the subject. The first section reviews the relation and influence of sunshine to man. It discusses the nature of the electromagnetic spectrum and the special types of emitted energy associated with photochemical reactions — infrared, thermic, ultraviolet, Dorno and visible radiations,— from both its scientific and historical background. Summarizing the evolution of photochemistry as a science, Plotnikow divides the historical data into three periods, the ancient or speculative, the intermediate as the technical, and the modern as the scientific. The succeeding three sections are so exhaustive that one can only but hint as to contents and trust that those especially interested will refer to them for special information. They deal at scholarly length with the interchangeable effects between matter and definite spectral radiation, considering the absorptive, penetrating and photochemical changes produced in different organic and inorganic materials; the problems of bioluminescence and fluorescence; a mathematico-technical dissertation on the kinetic and static action of light in relation to photoactivity, catalyzation and reaction; and the reaction of light in its broadest influence on the various inorganic and organic elements found in nature. An unusually rich bibliography is appended after each chapter. From what has been pointed out, this book undoubtedly will come to be regarded as the *vade* mecum—an indispensable guide for medical and special students interested in this promising field of radiation.

AMERICAN MARTYRS TO SCIENCE THROUGH THE ROENTGEN RAYS By *Percy Brown*, M.D., F.A.C.P., F.A.C.R., Historian and former President American Roentgen Ray Society. Cloth. Pp. *276*. Price, $3.50. Springfield, Ill.: Charles C. Thomas, 1936.

"To the memory of the noble pioneers whose biographies are herein written, almost all of them my dear friends, whose great triumphs and small disappointments it was my high privilege to share, this unworthy book is dedicated." It is in these words that the author of this unique book dedicates his pious labor, and it is in these words we see the praiseworthy *leitmotif* of the book, written by a man who has shared in the battles of science and who counts the comrades who fell on the field of honor. Men who give up their supreme possession so that humanity might benefit should remain immortal. Monuments of stone or metal become disintegrated and destroyed in time, but a monument erected in the hearts of one's fellow men, such as presented by this book, will outlast hand carved inscriptions. This written monument is much more than a record of the lives and activities of twenty-seven radiologists who died while on outpost duty. With masterly strokes the author has sketched the history of the discovery and the struggles that were needed to overcome obstacles until radiology became what it is today, freed of inherent danger to its followers. After this highly informative introduction, the author sketches the lives of the twenty-seven martyrs to a great cause, each chapter being illustrated by a portrait and sketches of the discoveries or especial devices invented by the concerned worker. There will be many non-medical men who will eagerly read this book because of its historic value. For them the author has provided a glossary of the scientific terms used in the text. Would that others might be inspired to imitate Dr. Brown and bring out books memorializing the achievements of American physicians in the domain of general medicine!

BALANCE SKILLS IN PHYSICAL EDUCATION. By *Charles LeRoy Lowman*, M.D., F.A.C.S., Chief of Staff Orthopedic Hospital, Los Angeles. Paper. Price $1.60. Pp. 42 with 13 illustrations, Ann Arbor, Edwards Brothers, Inc., 1935.

This is a monograph on the use of the tilted balance board. The author presents an excellent argument for its adoption. He believes it not only mechanically produces the realignment of the supporting structures, but also requires that active par-

(*Continued on page 450*)

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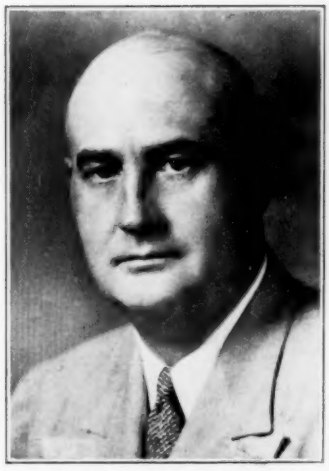

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EDITORIALS

FIFTEENTH ANNUAL SESSION

Elsewhere in this issue appears the scientific program of the forthcoming annual session of the American Congress of Physical Therapy. A full week will be devoted to the presentation of papers, addresses, group conferences, practical demonstrations and clinics dealing with many phases of our discipline. An afternoon has been set aside for the educational conference, which will be addressed by prominent medical teachers and administrators. For the first time in the history of our Congress the opening address will be delivered by an official representative of the Surgeon General of the Army, assuring a more intimate relation between the Medical Corps of our military services and our national body. The scientific exhibits will be augmented numerically, thoroughly diversified and highly informative. The technical exhibits, too, will merit careful inspection by all who are interested in the technical development of apparatus and equipment, as many new models will be shown for the first time.

Attention is also directed to the various specialistic group conferences. Never before have we been able to secure and offer such highly authoritative discussions of subjects of importance to all practitioners of medicine. While these conferences have been planned primarily for members especially interested in the respective symposia, it hardly needs stressing that all who so desire may attend any and all groups. In these conferences fundamentals will be treated rather informally, and each speaker will welcome discussions from the floor. Some of the subjects will be illustrated by photographs, lantern slides, motion pictures and the like.

The general scientific sessions will be more formal, discussants having been selected to develop the subjects presented. The large number of papers necessitates strict adherence to the allotted time limits. Chairmen have been urged to conduct the sessions on schedule. Papers requiring more than twenty minutes

for their reading should be presented in abstract, to avoid inopportune interruption.

The registration desk will be open Monday morning, September 7, at 9 o'clock. On that afternoon will be held the educational conference, which should elicit a good attendance even by those who have no immediate teaching connections. The business session will be held in the evening, and all members are urged to take an active interest in the transactions, as important matters are on the agenda in addition to the annual election of officers and selection of the next meeting place. Two interesting reports will be made during this business session. Our official delegate to the International Congress on Physical Therapy will survey the proceedings of that notable gathering recently held in London, England, and the secretary of the Council on Physical Therapy of the American Medical Association will give us a resumé of the research in our discipline achieved during the year.

The program proper will be initiated Tuesday morning, September 8, with the formal opening addresses to be delivered in the evening of that day. From then on the morning conferences and the afternoon general sessions will be carried out precisely as given in the official program, which members and their guests are urged to peruse in order to familiarize themselves with the diverse activities.

The annual Congress dinner is scheduled for Wednesday evening, September 9. It is the sole social function of the convention. Always an enjoyable affair, making not only for good fellowship, but for a greater mutual interest in everything pertaining to the success of Physical Therapy, all members, their ladies, guests, and exhibitors should attend this function, which this year promises to be an exceptionally gratifying one, thanks to the efforts of the local committee on arrangements. It will prove of help to that committee if the tickets for the dinner will be purchased at the registration desk at the time of registration or soon after.

Saturday, September 12, will be devoted to clinics at a number of the leading hospitals at New York City. The men in charge of these clinics have made elaborate preparations for practical demonstrations, so that those who will take in this part will be amply repaid with a large number of clinical demonstrations.

Due to the present railroad situation, special convention fares have been abolished, the rates having already been reduced to the minimum. There is no question that this year the item of transportation cost will be much less than the customary convention charges.

The Waldorf-Astoria has been chosen as our official headquarters, where all assemblies and exhibits will be housed. The management of this famous hotel will gladly confer with our members and their friends regarding accommodations and is in every possible way prepared to meet especial wishes. The Waldorf-Astoria has unusual facilities for our convention needs, so that all are assured of a sense of being "at home" during their sojourn under its roof.

The New York Physical Therapy Society through its local committee has fully cooperated with the aim of rendering this convention a decided success. We can only urge our members to not only take advantage of this opportunity in a scientific sense, but also as a vacation for themselves and their families. It will be a service rendered the cause of scientific physical therapy if they will inform their colleagues of this forthcoming event and invite them to come to the convention and take an active interest in the proceedings of what promises to be one of the outstanding medical gatherings of the year.

CONTROVERSY ABOUT CONVENTIONAL AND SO-CALLED SHORT WAVE DIATHERMY

Since time immemorial there has never been advanced a human thought or activity but what there did not arise numerous protestations and downright antagonisms, traceable to prejudices inherent in human psychology. There always has been and there always will be men who under a conservatism intended for the greater good, stem themselves with might and main against the inevitable changes in their habituated routine. One needs only to glance through the pages of history to realize that practically all revolutionary advances in the humanities or sciences recognized today as basic, had to break down the barriers of prejudice to gain recognition. Experiences emphasize that the radicalism of yesterday becomes the conservatism of today. The lesson learned from this is strikingly illustrated in a recently published book by Kowarschik[1] in which this distinguished leader in physical medicine points out the but natural tendency to overenthusiasm in short wave therapy similar in manifestation as in other contributions. Virtually the same thought is expressed by Kovács[2] who elsewhere in this issue discusses moot problems pertaining to both conventional and so-called short wave diathermy. This article contains assertions meriting earnest consideration but at the same time it also presents certain mature convictions which perhaps are more dogmatic than intended and as such are apt to create false impressions of the fundamental relationship between the two agencies under consideration.

One is constrained to resent the imputation that the medical profession is so ill-equipped to do its own thinking that it becomes a helpless tool of designing manufacturers. Admitting for the sake of argument that here and there some person engaged in the production of electro-therapeutic appliances is overemphasizing the value of his handiwork, this is no justification to challenge the integrity of all manufacturers as a class. This is as unjustifiable as it would be to charge the medical profession with quackery because of a small percentage of black sheep in our midst. The very contrary is the case. The assertion that "its introduction here (America) came primarily as a move by manufacturers who saw the commercial possibilities of exploitation" is easily refuted by a few unimpeachable facts. Is it not true that short wave in medicine emanated not from factories but from seats of learning and research? The answer is Schereschewsky at Harvard and d'Arsonval at the College de France. Is it not also a fact that in spite of the epochal discoveries by these two pioneers, years elapsed before either the medical profession or electrical engineers collaborated to make possible their clinical application? If anything the concerned manufacturers had to be aroused by the insistent demands on the part of our profession before they attempted to invest their resources for the production of high frequency apparatus. So much for placing the blame on the shoulders of others for our own shortcomings.

Every science possesses common characteristics of a definite nomenclature. A point raised by Kovács is that the term short wave therapy is incorrectly so designated. While to a certain extent this is partly admitted even by Schliephake, the question arises whether the offered designation is not equally objectionable. Let us not overlook that the term diathermy though accepted by usage is biophysically improper because the current does not heat through the body. On the other hand the biophysical effects of short and ultrashort waves are so greatly at variance from what we are pleased to call conventional diathermy that it is an open question whether the distant relationship between the two justifies their being grouped together. Inex-

perience may justify certain tentative appellations, but experience should preclude reduplication of the same error.

Another point raised against short wave diathermy is that it is not devoid of certain risks, e.g., especially burns. If this is to be made an issue it should be decisively directed against incompetence or carelessness and not against the method. The very example cited by Kovács is ample proof of the correctness of this statement. Is there any method in medicine that does not require especial skill for its effective application? The blessings of radiotherapy, of modern surgery, of pharmacotherapy, and even of hydro- and heliotherapy are attainable only by expert knowledge and constant care. Science is never wrong, but scientists are.

To reduce the therapeutic effects of short wave diathermy to the identical thermogenic properties of conventional diathermy means to throw overboard a vast amount of scientific research as useless ballast. It appears from the context that Kovács reaches this conclusion because he cannot accept laboratory experiments as applicable to the human. This is a bit surprising because the scientific foundation of all advances in our discipline have gone through the crucible of painstaking laboratory experiment. One need only think of the labors of Ehrlich, Pasteur, d'Arsonval, Wassermann, and countless others to realize that without the laboratory our modern procedure in diagnoses and therapy would be as meagre and as irrational as medieval medicine. Would that we had more test tube and less paper experts! This we are sure is the essence of Kovác's thesis. It seems only proper that with a number of problems still unsettled we should adopt a judicial attitude in the sense of postponing judgment until all competent witnesses have had their day in the court of science.

References

1. Kowarschik, Josef: Short Wave Diathermy, Vienna, Julius Springer, 1936.
2. Kovács, Richard: Clinical Comparison Between Diathermy and Short Wave Diathermy, Arch. Phys. Therap. X-Ray, Rad. **17**:432 (July) 1936.

MEETING OF WESTERN SECTION

The fourth annual meeting of the Western Section of the American Congress of Physical Therapy was held on June 18, last, in the auditorium of the Los Angeles County Medical Association Building. It was undoubtedly the best of the sessions in the history of the section, because the committee in charge had made every effort to provide an unusual program. That the efforts were appreciated is evidenced by the fact that members came all the way from San Diego and Oakland, California, to participate in the one-day meeting.

No less than twelve outstanding papers were presented. The guest speaker, President-elect William Bierman, had flown from his home in New York, and addressed the audience on the clinical use of short wave currents; the temperature of the skin with especial reference to the diagnosis and treatment of peripheral vascular disease; the treatment of gonorrhea in the female by systemic and pelvic heating; fever therapy. Among others than the guest speaker were such distinguished representatives of physical therapy and allied sciences as Mr. C. J. Breitwieser, research engineer; Dr. Henry Borsook, biologist; Dr. Robert C. Burt, physicist; Drs. Julius Scholtz and Vernon P. Thompson of the Medical Department of the University of Southern California; and Drs. Edward E. Crowe and A. Brockway, of the Orthopedic Hospital Center.

With the exception of a short intermission which was utilized by the members to visit a "bit of old Mexico" (Olivera Street), the meeting was held from early morning until late hours after the usual banquet. President J. Severy Hibben, of the Congress, presided over the festivity with the genial assistance of Dr. E. M. Pallette, President of the California State Medical Society. The meeting was addressed during the evening by the guest speaker, Dr. Harlan Shoemaker, President of the Los Angeles County Medical Association in addition to those on the regular program.

Success of this event which will be long remembered by the profession on the Pacific coast is due to Dr. Cora Smith King, Chairman of the Section and President of the Pacific Physical Therapy Association and to Dr. Fred Moor, chairman of the program committee, who was ably seconded by Drs. Kling and Hibben. Dr. Cleon W. Symonds, of Pasadena, too, merits appreciation for his active efforts to further the success of the meeting.

It was the consensus of opinion of the meeting that the Congress should be invited to hold its 1939 convention in Los Angeles, on the occasion of the San Francisco Bay Exposition, which will be held in that city.

EXAMINATION OF PHYSICAL THERAPY TECHNICIANS

Announcement is made of the next examination of physical therapy technicians for registration certificates of the American Registry of Physical Therapy Technicians. The examining board of the Congress will convene in connection with the fifteenth annual convention at 9:00 A. M. September 7, 1936, in the Carpenter suite on the fourth floor of The Waldorf-Astoria, New York City, to examine applicants who have been certified to as candidates. All who desire to take this examination should file an application on the prescribed form not later than August 15. No applicant will be permitted to take the examination whose authorized credentials and medical references are not filed with the Registrar. An application blank and information pertaining to the usual requirements may be obtained by addressing the registrar at the address found elsewhere in this issue.

The examining board will examine approved candidates both theoretically and practically in a manner which should enable those who have been interested in their work as technicians to pass with a good rating. Like in similar professional tests the board of examiners will take into consideration the character and length of service rendered in approved hospitals or under regular physicians.

New Radio Device Detects Leaks in Water Mains

Othmar W. Pies, valveman in the Water Department in Cincinnati, has perfected a device to detect leaks in water mains and pipes. As patented, his apparatus consists of a set-up of radio tubes with a very sensitive microphone pick-up which detects and locates the leaks. He connects his device with a fire hydrant, valve or ordinary house stop-cock having a direct connection with the main or house line.

A leak is disclosed by a sizzling sound which grows into a roar as the equipment nears the leak. By taking a reading on each side of the leak by use of a graph, he is able to find the exact location. He has seldom missed finding the leaking valve or pipe. — *Science News Letter.*

Hot Stars Provide New Evidence for Einstein

Very hot stars, with surface temperatures around 40,000 degrees, have provided the latest evidence in favor of the Einstein relativity theory.

Dr. Robert J. Trumpler, of the Lick Observatory, has found that the lines appearing in the spectra of those stars after their light has been analyzed through the prisms of a spectroscope, are shifted towards the red. This shift is greater than that shown by other stars closely associated with the hot ones. Dr. Trumpler expresses the view (*Publications of the Astronomical Society of the Pacific*, October) that this shift is similar to one found previously in the sun and other stars, and which was predicted by Einstein. It is believed to be due to the fact that the light waves are lengthened slightly when they leave such a massive body. — *Science News Letter.*

THE STUDENT'S LIBRARY

(*Concluded from page 442*)

ticipation of the eye and the labyrinthine mechanism so vital to the production of correct patterns, which should control our posture and movements of skill. There are chapters on the neuromuscular factors of body balance, the effect of posture on muscles and ligaments, balance exercises in the postural problem, the origin of the tilted balance board, psychomotor and other important factors in its use, contraindications, home application and suggested exercises. Dr. Lowman's balance board is of inestimable value in treating certain stubborn posture cases and pronated feet and is recommended to workers in the field of physical education and physical therapy.

THE SURGICAL TECHNIC OF ABDOMINAL OPERATIONS. By *Julius L. Spivack*, M.D., Assistant Professor of Surgery, University of Illinois College of Medicine; Professor of Operative Surgery and Surgical Anatomy, Cook County Graduate School of Medicine, etc. Cloth. Price $1.00. Pp. 718 with 677 illustrations on 362 figures. Chicago: S. B. Debour, Publishers, 1936.

There has been need of a book that vividly teaches the correct and detailed steps of abdominal operations, because most text-books are too generalized to stress details. Spivack has utilized his experience gained from contact with students and extensive research in abdominal surgery in the preparation of the text to meet the needs of all who, with the average grounding desire to acquire a good operative technic. All known abdominal operations and their diverse modifications have been presented lucidly and with painstaking attention to details. There are also numerous procedures not ordinarily found in text-books. Taking the chapter on gastrostomy as a cross section, we find full descriptions of the methods of Stamm, Witzel, Marwedel, Schnitzler, Kader, Ssabanejew, Helferich, Jaboulay and Lucy, Depage, Beck and Carrell, Janeway and Hirsch, Tavel, and Spivack. Historically and critically considered, the author recommends only the Stamm and his own comparatively simple but ingenious method. One may not always agree with the author's evaluation, as for example the present reviewer has always preferred the Witzel method until he became acquainted with the Spivack operation, but this is to be expected as a matter of personal experience and preference. This chapter conveys a fair idea of the extensive contents, which open with incisions, ligatures and closure of abdominal wounds, consider the essentials of surgical anatomy and then cover the entire gamut of operations on the gastrointestinal tract, the liver, spleen, gall bladder and the biliary ducts, pancreas, hernia and finally gynecologic operations, including Cesarean section. Spivack has also described his rule of finding a hidden appendix, a new method of establishing an artificial anus, and a "tunneled" anastomosis between the gall bladder and stomach. The *pièce de resistance* is seen in the many illustrations that actually visualize step after step of the operative procedures. Most of them are original, having been drawn by skillful artists under the direction of the author, to give a plastic effect. To readers with a bent for scholarship the book will also prove a source of information on the historic development of many operations, substantiated by a bibliography that is not easily accessible. In short Spivack has made an earnest effort to substitute clinical instruction under a scientific teacher to the extent possible by print. The format is in keeping with the importance and value of the book, which must be studied to be fully appreciated as a reliable guide to even the most difficult abdominal operative technic.

THE 1935 YEAR BOOK OF GENERAL THERAPEUTICS. Edited by *Bernard Fantus*, M.S., M.D., Professor of Materia Medica, Pharmacology and Therapeutics, University of Illinois College of Medicine, Member Revision Committee of the United States Pharmacopeia and of the National Formulary Revision Committee; Director of Therapeutics, Cook County Hospital. Pp. 469, Cloth. Price $2.25. Chicago: The Year Book Publishers, 1936.

Since the year 1935 has brought the medical profession not only a new revision of the U. S. Pharmacopeia but also a vast amount of contributions on general therapy, the present year book mirrors unprecedented progress in the treatment of disease. While the review is supposed to be limited to non-surgical therapy, it contains references to the injection treatment of hernia and hemorrhoids, to surgical skin disinfection, lumbar puncture in traumatic lesions of the central nervous system, and the like. The material dealing with pharmacotherapy is abstracted under the headings: antipathogen therapy, immunization, restoratives, tissue alternants, function modifiers and toxicology. Each of these principal groups has a number of subdivisions, one, for example, having such subheadings as: cathartics, diuretics, sedatives, vasoconstrictors, and the like. Non-pharmacal therapy is discussed under two groupings. One is headed "pyrexitherapy," which term Fantus suggests as more appropriate than those seen in the literature. The other is labeled: "Non-pharmacal Therapeutics," and contains a number of abstracts of articles on mechanical agents, hydrotherapy, thermic agents, radiant energy, electrotherapy, grenz ray therapy, electrotherapy and psychotherapy. This part of the book represents advances made in physical therapy, many articles having been abstracted from the ARCHIVES. It is not quite clear why Fantus has chosen one single article on electrosurgery of rectal cancer and another on surgical electrodesiccation and coagulation out of a large number of articles on these themes, especially not because such articles should have been incorporated in the volume on general surgery. In our opinion, this space could have been utilized to publish several outstanding contributions on short wave therapy which have been omitted in the present volume. With this sole shortcoming excepted, the book is a worthy successor of its predecesosrs.

SCIENCE, NEWS, COMMENTS

Artificial Radioactivity From 8 Elements Reported

Transmutation of the elements and artificial radioactivity by high energy atomic bombardment were reported to the meeting of the American Physical Society from the laboratories of the host institution, the University of California, Berkeley, Calif.

Eight different chemical elements, ranging from sodium and chlorine, found in common table salt, to rare platinum and deadly arsenic, give off piercing radiation like that from radium, according to papers presented by investigators working in the laboratory of Prof. E. O. Lawrence. Tool of accomplishment for the many researches was the giant 85-ton cyclotron magnetic accelerator apparatus, invented and developed by Prof. Lawrence.

The investigators not only have the immediate purpose of telling how atoms are put together but hold the hope of realizing some cheap yet effective substitute for costly radium in the treatment of cancer and its allied diseases.

Gamma radiation, the type of rays used in cancer hospitals, was reported by J. R. Richardson as being given off from sodium, chlorine and aluminum with energies as high as 3,400,000 volts.

Platinum became radioactive under deuteron bombardment, said Dr. J. M. Cork and Prof. Lawrence, and yielded radiation having energy of 4,500,000 volts. H. G. Paxton described experiments with radioactive phosphorus having a half life period of over 50 hours. Comparable experiments with zinc discussed by Dr. J. J. Livingood yielded artificial radioactivity having a half life of as much as 100 hours.

Most artificially radioactive elements retain their activity for only a few minutes at the most. The search, thinking of possible biological and medical applications, has been to find substances which would be active for longer periods. Radium, by comparison, has a half life of 1,600 years and, although costly, wears out, by disintegration, very slowly. The new reports on artificial activity lasting as long as five days are encouraging. — *Science News Letter.*

Normal Individuals Not Helped by "Pep-Up" Drugs

Don't expect to pep yourself up with coffee, alcohol, cocaine, morphine, strychnine, insulin, and adrenalin if you are a normal healthy person, just because they help sick people.

Drugs that are good for weak individuals may have an entirely opposite effect on one in good health, Dr. Walter R. Miles of Yale University, reports. Dr. Miles reached his conclusions after a series of experiments with animals demonstrating this dual action of common drugs on efficiency as shown by ability to run a maze.

The normal rat is not aided by any one of the drugs tried. But a blind rat, that is lacking in muscle tone, lying soft and limp in your hand if you pick it up, is helped by strychnine, by cocaine, and by thyroxin.

Neither caffeine nor alcohol helped them all. Morphine and insulin both reduced their skill somewhat and adrenalin had an even more disadvantageous effect. — *Science News Letter.*

Safer Vaccines Made by Chemical Treatment

Promise of a way to make safe vaccines against diseases for which there are as yet no safe vaccines appears in a report of Drs. Joseph T. Tamura and M. J. Boyd of the University of Cincinnati College of Medicine.

Instead of killing the disease germs by heat to make a vaccine, these investigators treat it with ketene. This chemical is produced by decomposing acetone, the chemical used in finger-nail polish remover.

Germs that cause dysentery were treated with ketene and used to vaccinate rabbits. The vaccinated animals were immune to doses of the untreated bacillus which killed unvaccinated rabbits in four days, the investigators report. (*Science*, Jan. 17).

While the investigations of the Cincinnati scientists were limited to one kind of "germ" — B. dysenterae Shiga, by scientific name — it may develop that ketene can be used to detoxify the organisms that cause other diseases, so that they can be safely used for vaccination. — *Science News Letter.*

TB Sanatoriums in U. S. Are Rated as "Fine"

The most complete data ever obtained on the hospitalization of tuberculosis patients in the United States are presented by the American Medical Association in its Journal (Dec. 7).

American sanatoriums, or hospitals for the tuberculous, provide beds for 95,198 patients and are on the whole fine institutions, the survey shows. Sixty per cent of their patients are definitely improved by the treatment given. These special hospitals represent an investment of $330,000,000, including land, buildings and equipment. Veterans' hospitals for the tuberculous cost on the average $4,000 a bed. In most other institutions, both private and public, the cost per bed is less, but there are extremes in variation.

Elaborate plants and expensive equipment bring the cost of some tuberculosis hospitals as high as $10,000 a bed. One sanatorium built with public money cost $13,043 a bed.

The use of tuberculosis departments in general

hospitals has been endorsed by the American Medical Association, the American Hospital Association and the National Tuberculosis Association. The endorsement, however, requires adequate segregation for the protection of other patients and personnel.

In a few of the sanatoriums, the survey revealed, adults and children are allowed to associate in various ways. In a few cases, too, it was found that children with tuberculosis of the lungs were hospitalized with children in the preventorium unit. Such conditions call for prompt correction, the Association's Journal makes plain in an editorial commenting on the survey.

No attempt was made to give a relative rating to the individual institutions. The comment that would characterize the tuberculosis institutions of the United States in general would in most cases be commendatory, states the Association's council on medical education and hospitals, under whose direction the survey was made. — *Science News Letter.*

New X-Ray Technique Aids Against Silicosis

A new tool of science to combat industrial dust diseases like silicosis has been developed by Prof. George L. Clark and Dexter H. Reynolds of the University of Illinois.

Silicosis is the occupational disease caused by breathing rock dust containing fine silica, especially in the form of quartz, and is claimed to have been responsible for the numerous deaths at the Gauley Bridge, West Virginia, power tunned now under Congressional investigation.

The new Illinois method is based on obtaining what amount to x-ray "fingerprints" of the quartz dust in a given sample of air from mine or factory. Not only is the kind of mineral present determined but the amount also is measured.

The dust from mine air is pulverized to a fine powder whose particles are smaller than one two-hundredths of an inch in diameter.

The dust powder is molded into a small wedge-shaped mass and placed in the x-ray analyzer. X-rays are then passed through the dust wedge and strike a sensitive photographic film which records an x-ray spectrum characteristic of the minerals composing the dust. This fingerprint spectrum tells what is present but without further research says nothing about the amount of each material present.

To determine how much quartz is in the sample of mine dust, a pure crystalline powder known not to be present is added to the sample in a given amount, say ten per cent.

The x-ray spectrum of this mixture is then recorded. The ratio of relative blackness of the x-ray lines of the known material to the blackness of the x-ray lines due to quartz in the dust samples is then determined. The ratio of line blackness is proportional to the amount of the quartz present in the dust, and can be converted into percentage amounts. The method is accurate of five per cent. — *Science News Letter.*

Find Drug That Will Keep Sleepy Persons Wide Awake

A drug to keep sleepy persons awake is now being used in medical treatment with pronounced success.

First report on the use of benzedrine for the treatment of what the doctors call narcolepsy, or sleep attacks, is made by Dr. Myron Prinzmetal of Los Angeles and Dr. Wilfred Bloomberg of Boston. (*Journal, American Medical Association,* Dec. 21).

Students especially are given to sleep attacks, and for these their own central nervous systems rather than their professors are to blame.

Nine cases of persons who fell asleep at least three times a day are reported by the physicians, whose work with benzedrine has been done in connection with the neurological service of Boston City hospital and Harvard Medical School. In each of the nine cases relief was complete when suitable doses were given. The drug also gives practically complete relief of cataplexy, a state of muscular rigidity produced by sudden emotion, shock or fear.

The studies made show benzedrine to be three times as effective in preventing attacks of sleep as ephedrine, the treatment usually given.

Seven of the cases reported were among students; the other two affected were a housewife and an office worker.

Three of the students suffered from momentary generalized weakness whenever they laughed. One girl had to give up college because she couldn't avoid falling asleep in classes.

An eleven-year-old school boy slept all the time he was not actively occupied, and consequently failed in his school work. One sleepy young man had been injured in a football game, after which he became more and more drowsy until he had six sleep attacks every day.

The two physicians state that benzedrine has a profound stimulating action on the higher centers of the central nervous system. It has been used in hayfever and asthma. — *Science News Letter.*

Plant Hormone Research Is Awarded $1,000 by A. A. A. S.

Some day you will be able to go to the drug-store and buy a salve that will make plant stems grow roots or your window box or garden develop more luxuriantly.

This promises to be the outcome of the plant hormones research by Drs. P. W. Zimmerman and A. E. Hitchcock which was awarded the $1000 prize of the American Association for the Advancement of Science meeting at St. Louis.

Fifteen new substances which cause striking effects when applied to plants were discovered and experimented with during the past year by Drs. Zimmerman and Hitchcock, working in the greenhouse and laboratories of the Boyce Thompson Institute for Plant Research in Yonkers just outside of New York City.

Roots were made to grow on stems, leaves and even parts of flowers of plants by rubbing on or injecting the plant hormones. This is nearly as startling to botanists as the unfulfilled ide

of growing hair on a bald head by some substance.

"New roots appear within three to six days wherever the hormone is administered," said Dr. Zimmerman in an exclusive statement to Science Service.

"The plant hormones or growth substances can be used as water solutions injected into the stem or added to the soil. One part in a million parts of water is very effective. The hormones can also be mixed with lanolin or oil and used as a salve. In this case it is applied to the aerial parts of the plant. Where the salve touches a stem or leaf, growth is accelerated and then roots arise within a few days. Propagation can be greatly facilitated by applying the substance a few inches back of a growing tip. When roots start the part is removed and planted as a new seedling."

First application of the new prize discoveries will probably be made by nurserymen who will use the hormones to start roots on growing branches which may be cut off and planted as slips.

This is not the first time their researches have been awarded a prize for Drs. Zimmerman and Hitchcock, together with Dr. William Crocker, director of the Boyce Thompson Institute, in 1932 were given the A. Cressy Morrison prize of the New York Academy of Sciences for showing that poisonous gas, carbon monoxide, could initiate and stimulate roots.

Carbon monoxide was the first pure chemical ever used experimentally to induce roots at unusual places upon plants. Since that time Drs Zimmerman and Hitchcock have found many other such chemicals. The most effective of these are the following synthetic chemicals made in their laboratory: Naphthalene acetic acid, four indole compounds and phenyl acetic acid. In addition to making these compounds, the scientists extract natural hormones from roots, flowers and ripening fruits.

Growing of what botanists call "adventitious" roots in strange places upon plants is the most spectacular effect of the plant hormones but it is also possible to make plants curl their stems and leaves, grow more luxuriantly in predetermined spots and proliferate in an unusual manner. — *Science News Letter.*

Solar Energy Now Caught With 15 Per Cent Efficiency

Practical utilization of the sun's rays to do the work of the world is forecast by a sun power machine exhibited by Dr. C. G. Abbot, secretary of the Smithsonian Institution, Washington, D. C., before the American Association for the Advancement of Science.

Within the last few months Dr. Abbot has greatly increased the efficiency of his sun power plant until now experiments indicate that fifteen per cent of the solar energy falling on the ray-gathering mirrors may be converted through a steam engine into mechanical work. Since double that efficiency or 30 per cent is considered good accomplishment for a conventional coal fired steam power plant, Dr. Abbott's arrangement of mirrors promises to attract the practical attention of power engineers in the near future.

The fuel of the sun power plant is free whenever and wherever the sun shines. It is not necessary to mine and transport coal, take oil from the ground or chop down fire wood. Sun power has the possibility of making waste deserts with their sunshine sources of power.

There is presented the spectacle of great batteries of mirrors covering waste land providing energy convertible into electricity for transmission to centers of population.

Dr. Abbot's new solar power plant is simple and inexpensive to build. He uses parabolic aluminum alloy mirrors which stay bright and untarnished. These focus the rays upon a dark opaque liquid that absorbs the heat and is thus raised to a temperature of 350 degrees. This sun-fired boiler could provide steam to run an engine that could generate electricity. No expensive and unusual constructions are needed in Dr. Abbot's device and no costly mechanical movements are needed to follow the sun, which were a feature of earlier and less efficient sun power plants.

Reports from Russia, Dr. Abbot said, indicate that an attempt to utilize solar heat practically is being made by Soviet engineers. Twenty to thirty years ago sun power plants were attempted in California, Arizona and Egypt but they were far less efficient. Dr. Abbott has made earlier experiments with solar heat, particularly for cooking purposes.

The fact that power can not be generated at night or when clouds cut off the sun's rays will prevent the sun plant from producing power continuously. Dr. Abbot suggests that in sunny hours surplus power could be stored in giant storage batteries or by pumping water into a reservoir.

If the solar power plants were to be installed over an area equal to that flooded by Boulder Dam Lake, the total capacity would be about 5,000,000 horsepower, Dr. Abbott estimated. It takes about six of the units for each horsepower, and about 72 square feet area would be required for the six units. At present, these units can be built for about ten dollars apiece, but with mass production methods, the cost could be reduced materially. Each one consists of simple machine-built parts that could be economically produced in large quantities. — *Science News Letter.*

Relief for Angina Pectoris, "Most Painful" Disease

Quick relief for the world's most painful and most rapidly increasing disease, angina pectoris, has been achieved by the simple inhalation of the chloroform-like drug called trichlorethylene, Dr. John C. Krantz, Jr., of the University of Maryland School of Medicine, Baltimore, reported to the meeting of the American Association for the Advancement of Science.

Patients with the fear of death upon them, dread-

ing the next seemingly inevitable attack of the excruciating heart pain that is said to be worse than childbirth or gallstones, get relief in a second from inhalation when the attacks occur.

As a routine treatment night and morning, crushing an ampule in a handkerchief makes attacks less frequent by a half or third. Clinical tests made by Dr. William Love, Jr., Baltimore physician, were successful in 15 out of 20 cases.

An extract of the pancreas from which insulin has been removed is also effective in the medical fight on angina, Dr. James C. Munch, Philadelphia pharmacologist, made known at the A.A.A.S. meeting. Tested on some 500 patients at New York, Santa Barbara, Mayo Clinic and Philadelphia, it brought seemingly permanent relief from angina attacks in 85 per cent of the cases.

Some patients needed no more treatment after daily injections for two weeks, others needed weekly treatments for several months thereafter before relief came.

Discovery of the usefulness of the pancreas hormone in angina came as a byproduct of the insulin treatment of diabetes. Some patients with both angina and diabetes had both diseases mitigated by the relatively crude insulin of the early days.

As insulin was refined to greater and greater perfection, it became less effective in angina. The scientists therefore looked in the impurities for the substance benefiting angina conditions, and the pancreas extract now being used resulted.

Dr. Munch estimates that angina pectoris, predominantly a "busy man's disease," magnified by increasing life expectancy, has about sextupled in frequency in the past 20 years. — *Science News Letter.*

Breathing Exercises Help Sufferers From Asthma

Asthma sufferers at King's College Hospital are being helped by a relatively simple but promising remedy, Dr. Marjorie Gillespie of Glasgow has reported. (*Lancet*, Sept. 28, 1935.)

The remedy consists of individually prescribed breathing exercises. Of 75 patients treated by this method, only eleven failed to be helped, Dr. Gillespie reports. These eleven seemed incapable of mastering control of the diaphragm for proper breathing. Older patients were as likely to benefit as younger ones but the length of time the patient had had asthma had much more to do with the results of the treatment. Those who had suffered longer were less likely to be helped.

The theory of these exercises upon which the treatment is based is that asthmatic patients are found to have during attacks congested and narrowed bronchioles through which air could be drawn but could not escape. The aim is to empty the lungs as far as possible, to reëducate the automatic diaphragmatic movements and to diminish chest breathing. When done properly, the exercises tend to relax contracting muscles and make ribs and chest walls more mobile.

Various types of exercises are used to suit individual patients, since some were found who could do one kind but could not be taught to do a different kind. The patients had with few exceptions been taking various drugs, but as their confidence in the treatment warranted it the drugs were gradually withdrawn, which usually was between four and eight weeks. Besides attending the special classes in breathing twice a week, they were urged to use the exercises whenever an attack seemed imminent.

The doctors at the clinic think the good results may be partly psychological. The nervous tension is reduced whenever a patient feels that he can relieve an impending attack by his own efforts.

Women recovered more quickly than men. About one-half of the patients claimed that they could check almost all but the most severe attacks if they began their exercises at the first suggestion of troublesome breathing.

In Germany Dr. D. K. Schütz has also been treating patients by a similar method. He has added to the breathing exercises a few physical exercises. He reports that two-thirds of his patients have been relieved of their symptoms. — *Science News Letter.*

Pituitary Gland Makes Skin Grow to Fit Body

The pituitary, tiny and powerful gland in the head, not only makes the body grow but makes all the parts of the body grow the right size in relation to each other, Dr. C. R. Stockard of Cornell University Medical College told members of the National Academy of Sciences.

Dogs with skin so much too big for their bodies that it fell into loose, flabby wrinkles were described by Dr. Stockard. These dogs had other symptoms that showed the pituitary was not functioning properly, although the gland was not causing overgrowth of the bones or giantism.

Examination of the pituitary gland in these dogs showed very abnormal arrangements and proportions of the cells within the gland. The condition was not one of overactivity of the gland, Dr. Stockard pointed out, but of another kind of abnormal activity.

From his own observations and those of other investigators, Dr. Stockard has concluded that the growth-controlling hormone made by the pituitary not only stimulates growth but also controls growth by a checking process. It is this latter activity of the gland and its hormone that keeps the skin, for example, from outgrowing the rest of the body. When the skin becomes thick and wrinkled because it is too large to cover the body smoothly, as happens in diseased conditions, the skin has been freed from the growth-regulating factor and just goes on growing and growing, as tissue does when removed from the body and kept alive in a test-tube. — *Science News Letter.*

Schliephake's Article

Owing to a delay in the transmission of several illustrations by Dozent Dr. Erwin Schliephake, it is impossible to publish the continuation of his article as announced in the preceding issue. The concluding part of his important contribution will be published at the earliest possible moment. We regret the unavoidable delay, but the circumstances happen to be beyond our control. — EDITOR.

INTERNATIONAL ABSTRACTS

The Use of Ultrashort Waves in Sinus Therapy. Conrad K. Gale.

Laryngoscope **45**:520 (July) 1935.

A patient with a permanent opening into the left antrum was used to determine heat penetration of ultrashort waves. Two condenser plates put 1½ inches distant from each cheek; 300 watts at 8 m. Mouth temperature at start, 98.5 degrees F. Temperature of air in sinus, 98.5 degrees F. The sinus opening was plugged with cotton. Patient was exposed for one-half hour, at the end of which time mouth temperature was 100 degrees F. The thermometer inserted into sinus showed 99 degrees F. Because of mechanical difficulty the thermometer could not be inserted far enough into the sinus to touch a wall and so determine that temperature. Ringer's solution was now put into the sinus and the patient exposed with the head held to the left. Unfortunately as the temperature was being taken after 15 minutes exposure, the patient moved his head, the solution ran out of the sinus and the temperature was not obtained. Lack of cooperation made further tests impossible. The above experiment was inconclusive so far as the interior of a sinus heating up on exposure to even 300 watts. The cause for this lies in the fact that it is impossible for ultrashort waves to penetrate through a normal sinus. The induced currents tend to flow around the walls and not through the sinus. The reason for this is that the air content of a sinus has a lower conductivity and dielectric constant than the walls. If the sinus were filled with pus or exudate, then according to the physics of ultrashort waves we would expect to find penetration of the induced currents through the exudate, with a subsequent rise in temperature.

Gale feels that his clinical observations are too limited to explain the causes for the results obtained, but from the experience gleaned from treating 50 chronic sinus conditions he believes that ultrashort waves are at present the best means of combating sinus infections. While his results were not 100 per cent perfect, each case acted as its own control, since other treatment without result had been previously given. For good results an ultrashort wave apparatus should have a minimum of at least 200 watts output. The position of the plates should be equidistant from the sides of the cheeks, or in the anteroposterior position. Until more is known about the modality it is impossible to control the penetration of the wave by manipulating the electrodes.

An Electrode Which Simplifies the Technic of Electrosurgical Treatment of Retinal Detachments. Mark J. Schoenberg.

Arch. Ophthal. **13**:252 (Feb.) 1935.

The Safar and Walker electrodes have been in use a sufficient length of time to prove their worth However, they have certain shortcomings: Some of the Safar electrodes consisting of one, two or three points are difficult to handle. The Walker single point electrodes ("micropins") overcome several of the disadvantages of the Safar electrodes. They can be completely sterilized and cleansed in the flame of a Bunsen burner, and by the aid of a special carrier they can be easily applied. But if used without being attached to threads they may get lost.

Realizing the shortcomings of the Safar and Walker electrodes, the author designed and used a single two-hook electrode. The points of the hooks penetrate the sclera in an oblique direction. The purpose of this feature is to obviate the sudden escape of the subretinal fluid and rapid collapse of the eyeball. In the cases in which this type of electrode has been used the fluid escaped slowly and in small amounts, and the operation could be finished with great ease. The advantage offered by the double hook electrode is especially appreciated in cases with tears situated far back, nearer the posterior pole. In cases of this kind in which torsion of the eyeball is very difficult, the hook electrode performs the double function of electrode and retractor. As the points of the hook are inserted in the superficial layers of the sclera, the current is released and the points penetrate the sclera; a slight traction rotates the posterior pole forward to the desired degree.

Detachment of the Retina by the Pyrometric Electrode. Leon Coppez.

Arch. Ophthal. **13**:1 (Jan.) 1935.

Scleral coagulation requires an objective method of measurement, which will give constant results whatever the condition may be. This can be attained by measuring the temperature of the coagulated area, which is now possible by means of my pyrometric electrode. The pyrometric electrode is a diathermic electrode which measures the temperature of the tissues at a definite place and at the exact moment of coagulation. Instead of reading the electric intensity on the milliamperemeter, one notes on the pyrometer the temperature to which the coagulated tissue has been brought. This method is based upon the principle of the electric thermometer. The electrode appears like an ordinary cautery, except that the ball forming the extremity is a plate 2.5 mm. in diameter. It is used just like an ordinary diathermic cautery, but instead of reading the milliamperemeter, one reads only the registration on the pyrometer.

The principle of this method is that it is not a

rapid coagulation, but a slow heating of the sclera, which is the only way to get uniform coagulation. Pyrometers always have a certain degree of inertia, and to know the exact temperature from 20 to 80 degrees C. it is necessary to work slowly for twenty to thirty seconds. With the same time of application and size of electrode, the same effect is always obtained at the same temperature, whatever the conditions may be. Consequently, it is possible to study the effects of treatment on the basis of precise anatomic findings in place of clinical approximations.

A New Method and End Results in the Treatment of Carcinoma of the Stomach and Rectum by Surgical Diathermy (Electrical Coagulation). Alfred A. Strauss.

J. A. M. A. **106**:285 (Jan. 25) 1936.

In previous publications Strauss and his associates have reported the effect of surgical diathermy in coagulation of the rectum. Forty-two cases have been treated by this method in eight and one-half years. Two deaths resulted immediately from the surgical diathermy. Since that time they have added thirty-one cases with only one death. These results have led to attempt similar experiments in other parts of the intestinal tract, including particularly inoperable carcinoma of the stomach. The cases were inoperable and of the type in which x-rays and radium have no effect. The author has treated two cases of carcinoma at the lower end of the esophagus, two of carcinoma of the cardiac end of the stomach and two of the lesser curvature.

Neurosyphilis: Its Treatment. Norman N. Epstein.

California and Western Med. **44**:186 (March) 1936.

During the past five years we have used several methods of producing artificial fever, including diathermy, a heat-cabinet method, and recently a method in which heat radiation from the body surface is prevented by wrapping the patient in a special manner with blankets. This method has been described recently (1935) in detail. The blanket method has the advantage that temperatures of therapeutic height and duration can be obtained with simplicity and with safety in trained hands. Antisyphilitic therapy by drugs can be given simultaneously with the pyrotherapy, and there is little interference with the patient's normal activities. This method of pyrotherapy is ideal for the ambulatory patient, and by its simplicity broadens the application of this type of treatment. Regardless of the method employed, the use of hyperpyrexia as a therapeutic agent is dangerous unless conducted in a properly equipped hospital, and by physicians and technicians trained in this work.

Effect of Hyperpyrexia in the Treatment of Chronic Recurrent Dermatoses. Isadore Rosen, Herbert Rosenfeld and Frances Krasnow.

Arch. Derm. and Syphil. **33**:518 (March) 1936.

The Clark Hyperpyrexator, reported on first by Schmidt (1933), was employed. It is a wooden cabinet containing saturated moist air and heated by infrared rays produced by a coil resistance unit and reflected from below. The temperature is measured electrically and recorded as a curve automatically. The long waves absorbed from the surface of the skin produce direct stimulation of the integument, and, compared with other methods, this has a decided advantage for cutaneous therapy. There are no electrical contacts with the skin, eliminating the danger of burns, and the patient lies on a couch without a binder or covering, which is important, especially in cases of generalized moist dermatologic conditions. The dosage and control are simple. Sweating takes place rapidly and copiously in from thirty to forty minutes; sweat may be collected easily for analysis from a rubber sheet beneath the patient, and the treatment may be terminated immediately if necessary.

The most important observations showed a decrease in the free cholesterol content in 81 percent of the cases after treatment, ranging from —26 to —49 per cent for the greater number. Values for total cholesterol, lecithin (phosphatide), albumin and globulin did not indicate a definite trend.

Patients who were improved showed an increasing amount of lactic acid in the sweat, whereas those who were not improved failed to show this trend. In some patients with normal skin the values for lactic acid decreased regularly after hyperpyrexia, whereas in others the course was irregular. The value for lactic acid in sweat usually ranged from ten to twenty times that for lactic acid in the blood.

The results thus far do not show any parallelism between the pH of the sweat and the corresponding lactic acid content.

The cell changes in the blood showed, first, leukopenia followed by leukocytosis. Differential counts showed at first a marked increase of band cells and a decrease of eosinophils followed by lymphocytosis and monocytosis. There seems to be a parallelism between these observations and the decrease in the free cholesterol content.

Hyperpyrexia, induced in a mild form by external heat through infrared rays in a moist cabinet, caused temporary clinical improvement in seventeen of eighteen patients with generalized chronic recurring dermatoses. Of these four have remained well for a period of four months; four have had mild relapses after a few weeks, and three have had severe relapses after varying periods. The others have passed from observation. The period of hospitalization was decidedly shortened. Some of the patients were sufficiently benefited to resume their former occupation, whereas previously they had been unable to do any type of work.

New Indications for Thermocauterization. L. Moszkowicz.

Münch. med. Wchnschr. **35,** 1935.

With an anus praeternaturalis, if the prolapsed intestinal mucous membrane and a small ring of the surrounding skin is cauterized with the Paquelin, a broad, ring-formed strip of granulation is formed. This forms scar tissue, with decided shrinking, in about two weeks, and so small a ring-formed scar results that it sometimes has to be somewhat dilated with Hegar sticks. The patient can now give himself an enema every morning, and he will not be bothered further during the day, if the diet is not too bulky, by his unnatural anus. Ring injection with ½ per cent Novocaine-suprarenin suffices for anaesthesia; the intestinal mucous membrane itself is insensitive.

This simple interference also provides a substitute for the sphincter, if the ring muscle has had to be removed in the radical operation of a carcinoma. The narrow circular scar on the intestinal opening has the advantage that after the daily enema in the morning, a normal evacuation follows, and the patient is not bothered by bowel movements during the day, because under the scar, there is an elastic band closing the opening, which can be easily verified by digital examination. The burning away of the protruding mucous membrane causes the ring musculature of the intestine lying below it to be shoved closer together. It lies in folds under the ring-shaped scar. Thus, a ring-shaped body of smooth musculature is formed. This cannot be regulated voluntarily, but closes the intestinal opening by means of tonic contractions. The os coccyx is not removed in the course of the radical operation, but only luxated backwards temporarily. Then the field of operation is exposed clearly enough. The intestinal stump which is pulled down is given the physiological bend backwards, which stops the fecal column just before the opening, because only then can the bowels be emptied normally on a closet.

With a prolapse of the rectum, stripes 1 cm. broad, 3 cm. from each other are burned with the Paquelin in the mucous membrane cylinder the whole length. Just at the anus, the longitudinal stripes are connected by a broad circular burn, which disturbs the mucous membrane completely where the mucous membrane joins the skin, and besides, a narrow ring-formed stripe of skin is also cauterized. The injection of cocaine under the area of operation is only necessary for the skin (as above). On the ventral side of the prolapse, caution is necessary (only the mucous membrane should be cauterized!) because here a Douglas hernia may lie under the rectum. After the cauterization, the entire prolapse is shoved back into the pelvis. For 14 days, a predominantly fluid diet is prescribed, which produces only small quantities of feces (soups, tea, coffee, milk, lemonade with plenty of sugar, cream, zwieback with butter). From the third day on, the rectum is washed out daily with the help of a thin rubber catheter. The temperature is moderately high, the complaints, slight. Even during the first two weeks, the rectum becomes so stiff as the result of the severe infiltrations from the cauterization, that it does not prolapse, with cautious pressing. Now, the step may be made to mealy, but cellulose-poor diet (fruit, lettuce, vegetables, potatoes, etc. forbidden). The intestines should be washed out daily, a sitz bath taken several times a day. The patients can now walk around, and are instructed to exercise the sphincter regularly. The sphincter muscle is no longer relaxed, due to the cauterization wounds, and contracts strongly. The act of pressing must be eliminated for a time by means of regular eliminations, made easy by enemas. — [Ars Medici **1**:21 (Jan.) 1936.]

The Treatment of Iritis. Samuel J. Meyer.

Illinois M. J. **69**:232 (March) 1936.

In the treatment of endogenous iritis it is of the utmost importance to consider the underlying etiology. When this is known, treatment is employed to eradicate whatever the source of infection may be. There are, however, many cases in which the etiologic factor cannot be found, and the treatment must be empirical. Of utmost importance is the use of heat in some form to increase the hyperemia. Formerly this was accomplished by the use of hot moist applications. Lately the more hygienic and easily applicable electrothermophore, diathermy and most recently short wave diathermy, have been used. The last proved very efficacious. Infrared or therapeutic heat lamps may also be used at two to four hour intervals.

Some Observations on Retinal Detachments. Edward Nicholas DeWitt.

J. M. A. Alabama **5**:173 (Nov.) 1935.

Not all cataracts are or should be removed by the same method, since some require an entirely different type of method than others, if the best results are to be obtained. It is the same with operations for detachment of the retina. There are many cases in which the Gonin operation, with its minimum of trauma, is the most suitable; others in which it is not sufficient because it does not cover a large enough area. The Gonin technic is preferable in cases with small tears such as punched out holes, small horseshoe-shaped or slit-like tears. These require the most accurate study and afford many of the best results if the Gonin technic of localization and operation is accurately followed. The endothermic surface cauterization is best in cases where there are multiple tears, tears of the larger variety, disinsertions, and detachments where no tear can be found. These types of operation cover a greater area of the globe and with proportionately greater trauma. The technic, while not so accurate, perhaps succeeds in such cases in replacing more retina than the Gonin operation, and it also requires less experience and less precise localization of the tear.

ANNOUNCEMENT

Preliminary Program

FIFTEENTH ANNUAL SCIENTIFIC CLINICAL SESSION

American Congress of Physical Therapy

SEPTEMBER 7, 8, 9, 10, 11, 1936

The Waldorf-Astoria

New York

▼

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RULES GOVERNING THE READING OF PAPERS AND DISCUSSIONS

No address or paper before the Congress shall occupy more than twenty minutes in its delivery and no member shall speak more than five minutes or more than one time on any one subject, provided, each essayist be allowed three minutes in which to close the discussion. This rule must be strictly adhered to.

All papers read before the Congress shall be the property of the Congress for publication in the official journal. Each paper shall be deposited with the Secretary when read.

No paper shall be published except upon recommendation of the Publication Committee, which shall consist of the Editor as Chairman and other duly appointed members of the Congress.

GENERAL INFORMATION

While the 15th annual session officially opens for registration on Monday, September 7, the formal opening of the Congress will not take place until Tuesday evening, September 8. The regular scientific sessions begin on Tuesday morning, September 8 (See schedule of daily activities).

REGISTRATION is required of all members and guests as no one will be admitted to any of the conferences or lectures without proper identification. There will be no registration fee.

The EDUCATIONAL CONFERENCE will be held on Monday afternoon, September 7, and should prove of unusual interest to teachers, technicians and others concerned in the training of physical therapy.

The program proper begins with the CLINICAL CONFERENCE GROUPS on Tuesday morning, September 8. It is not intended to have a large attendance at these sessions as they have been planned primarily for the purpose of didactic instruction without, however, the formality of the latter. Every specialty is duly represented so that those who are interested only in certain specialties may arrange their time to the best advantage.

SCIENTIFIC AND TECHNICAL EXHIBITS

Every one attending the sessions is urged to inspect the technical and scientific exhibits. These have been arranged with great care and should prove of unusual interest. The number of scientific exhibits has been greatly augmented this year. Suitable awards in the form of medals will be announced at the annual dinner on Wednesday, September 9. Announcement of gold key awards will also be made on this occasion.

THE ANNUAL DINNER

The annual Congress dinner will be held on Wednesday evening, September 9, arrangements being under the direction of the New York Physical Therapy Society. Members, exhibitors, guests and their ladies are urged to secure their dinner tickets when registering. A splendid program has been arranged for this social function.

DIRECTORY OF MEETING ROOMS AND EXHIBITS

Registration — SILVER CORRIDOR (3rd Floor).

Technical Exhibits —

ASTOR GALLERY (3rd Floor).
JADE ROOM (3rd Floor).

Scientific Exhibits—

LE PERROQUET SUITE (4th Floor).
BASILDON ROOM (3rd Floor).

General Scientific Sessions —

GRAND BALLROOM (3rd Floor).
THE SERT ROOM (Lobby Floor)

Group Conferences:

MEDICINE — CRANE ROOM 4 U (4th Floor).

EXERCISE — LE PERROQUET SUITE (4th Floor).

SURGERY — ASSEMBLY ROOM (4th Floor).

EENT — JANSEN SUITE (4th Floor).

GASTROENTEROLOGY — EMPIRE ROOM (Lobby Floor).

HYDROTHERAPY — LE PERROQUET SUITE (4th Floor).

Business Session — EMPIRE ROOM (Lobby Floor).

Educational Conference — EAST FOYER (3rd Floor).

Publicity Headquarters — CRANE ROOM 4V (4th Floor).

SCHEDULE OF DAILY ACTIVITIES

15th Annual Session

MONDAY, September 7

8 A.M. Registration — Silver Corridor (3rd Floor).
9 A.M. EXAMINATION OF TECHNICIANS — Carpenter Suite (4th Floor).
12 to 2 P.M. Luncheon — Inspection of Exhibits.
2 to 5 P.M. Educational Conference — East Foyer (3rd Floor).
5 to 6 P.M. Inspection of Exhibits.
6 to 8 P.M. Dinner and Inspection of Exhibits.
8 to 10:30 P.M. Business Session and Smoker — Empire Room (Lobby Floor).

TUESDAY, September 8

8 A.M. Registration — Silver Corridor (3rd Floor).
9 to 12 Noon. Clinical Conference in Sections.
(a) SECTION ON EXERCISE — Le Perroquet Suite (4th Floor).
(b) SECTION ON MEDICINE — Crane Room 4 U (4th Floor).
(c) SECTION ON SURGERY — Assembly Room (4th Floor).
(d) SECTION ON GASTROENTEROLOGY — Empire Room (Lobby Floor).
(e) SECTION ON EENT — Jansen Suite (4th Floor).
12 to 2 P.M. Luncheon and Inspection of Exhibits.
GENERAL SCIENTIFIC SESSION — Grand Ballroom (3rd Floor).
2 to 5 P.M. SECTION ON EENT — Jansen Suite (4th Floor).
5 to 7 P.M. Dinner and Inspection of Exhibits.
7:30 P.M. FORMAL OPENING SESSION — Grand Ballroom (3rd Floor).

WEDNESDAY, September 9

8 A.M. Registration — Silver Corridor (3rd Floor).
9 to 12 Noon. Clinical Conferences in Sections.
(a) SECTION ON SURGERY — Assembly Room (4th Floor).
(b) SECTION ON MEDICINE — Crane Room 4 U (4th Floor).
(c) SECTION ON HYDROTHERAPY — Le Perroquet Suite (4th Floor).
(d) SECTION ON EENT — Jansen Suite (4th Floor).
(e) SECTION ON GASTROENTEROLOGY — Empire Room (Lobby Floor).
12 to 2 P.M. Luncheon and Inspection of Exhibits.
GENERAL SCIENTIFIC SESSION — Grand Ballroom (3rd Floor).
2 to 5 P.M. SECTION ON EENT — Jansen Suite (4th Floor).
6:30 P.M. ANNUAL CONGRESS DINNER — The Sert Room (Lobby Floor).

THURSDAY, September 10

8 A.M. Registration — Silver Corridor (3rd Floor).
9 to 12 Noon. GENERAL SCIENTIFIC SESSION — Grand Ballroom (3rd Floor).
12 to 2 P.M. Luncheon and Inspection of Exhibits.
2 to 5 P.M. GENERAL SCIENTIFIC SESSION — The Sert Room (Lobby Floor).
5 to 6 P.M. Inspection of Exhibits.
6 to 8 P.M. Dinner and Inspection of Exhibits.
8 P.M. GENERAL SCIENTIFIC SESSION — The Sert Room (Lobby Floor).

FRIDAY, September 11

8 A.M. Registration — Silver Corridor (3rd Floor).
9 to 12 Noon. GENERAL SCIENTIFIC SESSION — Grand Ballroom (3rd Floor).
12 to 2 P.M. Luncheon and Inspection of Exhibits.
2 to 5 P.M. GENERAL SCIENTIFIC SESSION — Grand Ballroom (3rd Floor).

SATURDAY, September 12

HOSPITAL CLINICS — See page 467

EDUCATIONAL CONFERENCE

MONDAY, September 7, 2 P.M.
East Foyer, 3rd Floor

OFFICERS OF THE SECTION

Chairman.....WILLIAM BIERMAN, M.D., New York
Secretary.....N. H. POLMER, M.D., New Orleans

1. **Educational Standards for Physical Therapy Technicians.**
O. N. ANDERSEN, M.D., Council on Medical Education and Hospitals, American Medical Association.
CHICAGO.
2. **The Teaching Value of the Cancer Clinic in Medical and Dental Schools.**
GRANT E. WARD, MD., Instructor in Surgery, Johns Hopkins Medical School; Associate in Surgery, University of Maryland Medical School.
BALTIMORE.
3. **Ten Years Experience with Licensing Physical Therapists.**
H. H. HORNER, Esq., Assistant Commissioner of Higher Education, Department of Education, State of New York.
ALBANY, N. Y.
4. **Some Aspects of Occupational Therapy as Demonstrated in a General Hospital.**
MARGARET OLIVER HEWELETT, O. T. Reg., Director, Department of Occupational Therapy, Presbyterian Hospital.
NEW YORK.
5. **American Registry of Physical Therapy Technicians.**
MARION G. SMITH, B.S., Registrar.
CHICAGO.

BUSINESS SESSION *

Monday, September 7, 8 P.M.
Empire Room (Lobby Floor)

A. **Routine Business.**
B. **Reports of Special Committees.**
C. **Report: The Sixth International Congress on Physical Medicine.**
RICHARD KOVACS, M.D.—Official Delegate.
D. **The American Registry of Physical Therapy Technicians.**
WILLIAM BIERMAN, M.D.—Chairman, Board of Registry.
E. **Research and Physical Therapy.**
HOWARD A. CARTER, B.S. in M.E.
Secretary, Council on Physical Therapy, American Medical Association.

SMOKER AND FELLOWSHIP GATHERING

* This will be the only business meeting during the 15th annual session.

CLINICAL CONFERENCES

SECTION ON EXERCISE

TUESDAY, September 8, 9 A.M.

Le Perroquet Suite, 4th Floor

OFFICERS OF THE SECTION

Chairman — K. G. HANSSON, M.D., New York.
Secretary — CASSIUS LOPEZ DE VICTORIA, M.D., New York.

111. Principles Underlying the Prescription of Corrective Exercises.

HARRY EATON STEWART, M.D., Director, New Haven School of Physical Therapy.
NEW HAVEN, CONN.

112. Mechanisms of the Erect Posture.

ROYAL STORRS HAYNES, M.D., Consulting Physician, Willard Parker Hospital.
NEW YORK.

Discussion: Walter Truslow, M.D., Brooklyn; Stella S. Bradford, M.D., Montclair, N. J.; R. E. Brenneman, M.D., Meadville, Pa.

113. Restoration of Muscle Balance in the Treatment of Sciatic Pain.

RAYMOND E. LENHARD, M.D., Instructor in Orthopedic Surgery, Johns Hopkins University Medical School,
and
HENRY O. KENDALL, M.D., Chief Physical Therapist, Children's Hospital School.
BALTIMORE.

Discussion: B. Billman, M.D., Cincinnati; Esther Frankel, M.D., Chicago.

114. Lumbo Sacral Derangement and Its Manipulative Treatment.

B. S. TROEDSSON, M.D., Director, Physical Therapy Department, The Bryn Mawr Hospital.
BRYN MAWR, PA.

115. Low Back Pain.

WALTER I. GALLAND, M.D., Associate Orthopedic Surgeon, Lenox Hill Hospital and Hospital for Joint Diseases.
NEW YORK.

Discussion: Halford Hallock, M.D., New York; Frank H. Walke, M.D., Shreveport, La.; Ralph H. Henry, M.D., Allentown, Pa.; Harold M. Herring, M.D., New York; Henry Cogan, M.D., Paterson, N. J.

SECTION ON MEDICINE

TUESDAY, September 8, 9 A.M.

Crane Room, 4U, 4th Floor

OFFICERS OF THE SECTION

Chairman — RICHARD KOVÁCS, M.D., New York.
Secretary — SIDNEY LICHT, M.D., New York.

SYMPOSIUM ON IONTOPHORESIS

121. Treatment of Varicose Ulcers by Iontophoresis.

JOSEPH KOVACS, M.D., Instructor in Medicine, New York Post Graduate School, Columbia University.
NEW YORK.

122. General Aspects and New Applications of Electrophoresis in Physical Therapy.

KARL HARPUDER, M.D., Attending Physical Therapist, Montefiore Hospital.
NEW YORK.

123. Studies on the Administration of Iontophoresis of Acetyl Beta Methyl Choline Chloride; Systemic Effects and Therapeutic Application in Arthritis.

LAY MARTIN, M.D., Instructor in Medicine, Johns Hopkins University Medical School.
BALTIMORE.

124. Development and Progress of Histamin Iontophoresis in Rheumatic Conditions and Deficiencies of Peripheral Circulation.

DAVID H. KLING, M.D., Assistant Professor of Orthopedics, College of Medical Evangelists; Director, Arthritis Clinics, Cedars of Lebanon Hospital.
LOS ANGELES.
and
DAVID SASHIN, M.D., Adjunct Attending Orthopedic Surgeon, Hospital for Joint Diseases.
NEW YORK.

Discussion: Jacob Urdang, M.D., Brooklyn; William B. Martin, M.D., Atlantic City; Frank H. Krusen, M.D., Rochester, Minn.; N. H. Polmer, M.D., New Orleans.

SECTION ON SURGERY

TUESDAY, September 8, 9 A.M.

Assembly Room, 4th Floor

OFFICERS OF THE SECTION

Chairman — JEROME WEISS, M.D., New York.
Secretary — DAVID H. KLING, M.D., Los Angeles.

SYMPOSIUM ON FRACTURES

131. Diathermy and Regeneration of Bone.

EDWIN DAVID WEINBERG, M.D., Instructor in Orthopedic Surgery, Johns Hopkins University Medical School.
BALTIMORE.

132. Delayed Union of Fractures.

ALLEN F. VOSHELL, M.D., Professor of Orthopedic Surgery, University of Maryland.
BALTIMORE

133. End Results of the Treatment of Colles Fractures.

M. E. KNAPP, M.D., Director, Department of Physical Therapy, General Hospital.
MINNEAPOLIS.

134. The Rôle of Physical Therapy in Fractures.

ROBERT H. KENNEDY, M.D., Associate Professor of Clinical Surgery, New York Post Graduate Medical School, Columbia University.
NEW YORK.

135. Compression Fractures: Care and Treatment After Reduction.

VAL PARMLEY, M.D., Professor of Traumatic Surgery, University of Arkansas School of Medicine.
LITTLE ROCK, ARK.

Discussion: G. E. Barr, M.D., Sioux City, Ia.; Merrill K. Lindsay, M.D., New Haven, Conn.; A. T. Legg, M.D., Boston; George L. Schneider, M.D., Williamsport, Pa.

SECTION ON GASTROENTEROLOGY

TUESDAY, September 8, 9 A.M.

Empire Room, Lobby Floor

OFFICERS OF THE SECTION

Chairman — James W. Wiltsie, M.D., Binghamton, N. Y.
Secretary — Samuel A. Warshaw, M.D., Brooklyn.

141. Chronic Intestinal Toxemia.

ANTHONY BASSLER, M.D., Consulting Gastroenterologist, St. Vincent's, St. John's Hospitals.
NEW YORK.

Discussion: Frank A. Cummings, M.D., Providence, R. I.; J. C. Kibler, M.D., Corry, Pa.; Louis L. Perkel, M.D., Jersey City, N. J.

142. Present Day Use of Physical Therapy in the Treatment of Diseases of the Colon.

ROY LYMAN SEXTON, M.D., Gastroenterologist, Sibley Memorial and Providence Hospitals.
WASHINGTON, D. C.

Discussion: C. J. Slocum, M.D., Beacon, N. Y.; Ephraim Goldfain, M.D., Oklahoma City, Okla.; Sigurd W. Johnsen, M.D., Passaic, N. J.

143. Remote Effects of Absorption of Toxins from the Colon.

CORA SMITH KING, M.D., Hollywood Hospital.
HOLLYWOOD, CAL.

Discussion: Fred B. Moor, M.D., Loma Linda, Cal.; H. Marshall, M.D., Gardner, Mass.

144. Clinical Value of Colonic Irrigation Therapy.

R. GARFIELD SNYDER, M.D., Associate Attending Physician, Department of Medicine and Pediatrics, Hospital for Ruptured and Crippled.
NEW YORK.

Discussion: Walter Bastedo, M.D., New York; Jacob Gutman, M.D., Brooklyn.

SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

TUESDAY, September 8, 9 A.M.

Jansen Suite, 4th Floor

OFFICERS OF THE SECTION

Chairman — Oscar B. Nugent, M.D., Chicago.
Secretary — Lewis J. Silvers, M.D., New York.

151. Evaluation and Technique of Roentgen Ray and Radium Treatment in Chronic Nose and Throat Infections.

J. THOMPSON STEVENS, M.D., Staff, Community Hospital; St. Joseph's Hospital, etc.
NEW YORK.

152. X-ray Treatments of Sinusitis.

ROMEO A. LUONGO, M.D., Instructor in Otolaryngology, Graduate School of Medicine, University of Pennsylvania.
PHILADELPHIA.

153. Value of Short Wave Diathermy in the Treatment of Sinusitis.

THOMAS LEICHNER, M.D., Instructor of Physical Therapy, Jefferson Medical College
and
WILLIAM H. SCHMIDT, M.D., Associate in Physical Therapy, Jefferson Medical College.
PHILADELPHIA.

154. Physical Agents in Relation to the Treatment of Nasal Sinusitis.

HARRY K. TEBBUTT, JR., M.D., Assistant in Otolaryngology, Albany Medical College.
ALBANY, N. Y.

Discussion: A. R. Hollender, M.D., Chicago; Conrad Gale, M.D., New York; Harry Rosenwasser, M.D., New York; Cleon W. Symonds, M.D., Pasadena.

155. Further Studies with Zinc Ionization in the Treatment of Trachoma.

SAMUEL EDISON, M.D., Associate in Ophthalmology, Michael Reese Hospital.
CHICAGO.

Discussion: Walter R. Loewe, M.D., New York; R. D. Tomlinson, M.D., New York; William Frank Gordon, M.D., Danbury, Conn.

SECTION ON OPHTHALMOLGY AND OTOLARYNGOLOGY

TUESDAY, September 8, 2 P.M.

Jansen Suite, 4th Floor

OFFICERS OF THE SECTION

Chairman — Frederick L. Wahrer, M.D., Marshalltown, Ia.
Secretary — Farel Jouard, M.D., New York.

156. Electrocoagulation in Bronchogenic Conditions.

JOHN D. KERNAN, M.D., Professor of Otolaryngology, School of Medicine, Columbia University.
NEW YORK.

Discussion: M. H. Cottle, M.D., Chicago; H. H. Forbes, M.D., New York; Rudolph Kramer, M.D., New York; Mervin Myerson, M.D., New York.

157. Correction of Retinal Separation by Diathermy and Katholysis.

LUTHER C. PETER, M.D., Professor of Diseases of the Eye, Graduate School of Medicine, University of Pennsylvania.
PHILADELPHIA.

158. Electrosurgical Management of Retinal Separation.

OSCAR B. NUGENT, M.D., Professor of Ophthalmology, Chicago Eye, Ear, Nose and Throat College.
CHICAGO.

Discussion: Walter R. Loewe, M.D., New York; Ramon Castroviejo, M.D., New York; Mark J. Schoenberg, M.D., New York.

159. Value of Ionization in Certain Nose, Throat and Ear Conditions.

PHILIP STOUT, M.D., Consultant Laryngologist to the Department of Allergy, Jefferson Medical College.
PHILADELPHIA.

160. Has Ionization Been Successful in the Treatment of Allergic Rhinitis?

THOMAS H. ODENEAL, M.D., Staff, Beverly Hospital; Beverly, Mass.; North Shore Babies Hospital, Salem, Mass.; etc.
SALEM, MASS.

Discussion: M. L. Harris, M.D., Brooklyn; Meyer Gorin, M.D., Rochester, N. Y.; Frederick L. Wahrer, M.D., Marshalltown, Ia.

GENERAL SCIENTIFIC SESSION

TUESDAY, September 8, 2 P.M.

Grand Ball Room, 3rd Floor

OFFICERS OF THE SECTION

Chairman — Heinrich Wolf, M.D., New York.
Secretary — M. E. Knapp, M.D., Minneapolis.

SYMPOSIUM ON VASCULAR DISEASES

161. **Passive Vascular Exercise in the Treatment of Peripheral Vascular Diseases.**
GEORGE H. YEAGER, M.D., Assistant in Surgery, University of Maryland.
BALTIMORE.

162. **Recent Advances in Physical Therapy Management of Peripheral Vascular Diseases.**
BEVERLY CHEW SMITH, M.D., Assistant Surgeon, Presbyterian Hospital.
NEW YORK.

163. **Critical Comments on the Present Therapy of Peripheral Vascular Diseases.**
IRVING SHERWOOD WRIGHT, M.D., Associate Physician and Chief, Medical Clinic, Post Graduate Hospital, Columbia University.
NEW YORK.

164. **Treatment of Obliterative Vascular Diseases of the Extremities.**
J. ROSS VEAL, M.D., Assistant Professor of Surgery, Louisiana State University.
NEW ORLEANS.

Discussion: J. H. Gibbons, Jr., M.D., Philadelphia; F. H. Krusen, M.D., Rochester, Minn.; Bertram M. Bernheim, M.D., Baltimore; Edward Allen Edwards, M.D., Boston; Leopold Brahdy, M.D., New York.

Attend

THE ANNUAL CONGRESS DINNER

Wednesday Evening

SEPTEMBER 9, 6:30 O'CLOCK

The Sert Room

The Waldorf-Astoria

Members, guests and their ladies are cordially invited to attend this one social gathering of the convention. A splendid program is being arranged. **Be sure to secure dinner tickets at registration desk as early as possible.**

FORMAL OPENING SESSION

TUESDAY, September 8, 8 P.M.

Grand Ball Room, 3rd Floor

John Severy Hibben, M.D., Pasadena, *Presiding*

INVOCATION

Reverend Charles D. Trexler
Lutheran Church of St. James, New York

ADDRESSES OF WELCOME

Charles E. Farr, M.D.
President, New York County Medical Society

Milton J. Goodfriend, M.D.
President, Bronx County Medical Society

Henry Joachim, M.D.
President, Kings County Medical Society

James Matthew Dobbins, M.D.
President, Queens County Medical Society

William C. Buntin, M.D.
President, Richmond County Medical Society

Peter Irving, M.D.
Secretary, Medical Society of the State of New York

Jerome Weiss, M.D.
President, New York Physical Therapy Society

INDUCTION OF THE PRESIDENT-ELECT

ADDRESS:

Electricity and Medicine

William Bierman, M.D., New York

FOURTH ANNUAL WILLIAM BENHAM SNOW MEMORIAL LECTURE

THE ROLE OF PHYSICAL THERAPY IN FRACTURES

Major Oral B. Bolibaugh
Medical Corps, U. S. Army, in charge of Physical Therapy, Walter Reed General Hospital, Washington, D. C.

ADDRESS

CONCERNING PATHOLOGICAL CHANGES OF THE CIRCULATION

Norman Cole, M.D.

Assistant Director of Physical Therapy, Johns Hopkins Hospital, Baltimore.

CLINICAL CONFERENCES

SECTION ON SURGERY

WEDNESDAY, September 9, 9 A.M.

Assembly Room, 4th Floor

OFFICERS OF THE SECTION

Chairman — A. F. Tyler, M.D., Omaha.

Secretary — Jos. Scattergood, Jr., M.D., West Chester, Pa.

SYMPOSIUM ON DERMATOLOGY

201. X-ray as a Method of Choice in the Treatment of Certain Skin Affections.

DAVID BLOOM, M.D., Assistant, Dermatology and Syphilis, Bellevue and New York University Clinics.

NEW YORK.

202. Treatment of Skin Tumors.

JOSEPH JORDAN ELLER, M.D., Assistant Professor of Dermatology and Syphilology, New York Post Graduate Medical School, Columbia University.

NEW YORK.

203. Treatment of Keloids.

WILLIAM JOSEPH HOFFMAN, M.D., Adjunct Radiologist, Lenox Hill Hospital and Associate Surgeon and Director of Tumor Clinic, Queens General Hospital.

NEW YORK.

204. Treatment of Cutaneous Tuberculosis.

ANTHONY C. CIPOLLARO, M.D., Associate, College of Physicians and Surgeons, Columbia University; Associate in Dermatology and Syphilology, Skin and Cancer Unit, New York Post Graduate Medical School and Hospital, Columbia University.

NEW YORK.

Discussion: R. W. Fouts, M.D., Omaha; Henry G. Munson, M.D., Philadelphia; Park A. Deckard, M.D., Harrisburg, Pa.; Patricia H. Drant, M.D., Philadelphia; Jos. Scattergood, Jr., M.D., West Chester, Pa.

205. Serial Utero-Salpinography.

MORTIMER N. HYAMS, M.D., Assistant Professor of Gynecology, College of Physicians and Surgeons, Columbia University.

NEW YORK.

Discussion: Henry G. Munson, M.D., Philadelphia; Margaret H. Sutley, M.D., Philadelphia; Emil Rundquist, M.D., New York; Harbeck Halsted, M.D., New York.

SECTION ON MEDICINE

WEDNESDAY, September 9, 9 A.M.

Crane Room, 4U, 4th Floor

OFFICERS OF THE SECTION

Chairman — Frank H. Krusen, M.D., Rochester, Minn.

Secretary — W. J. Egan, M.D., Milwaukee.

211. Further Experimental and Clinical Observations in Cerebral Diathermy.

ALBERT A. MARTUCCI, M.D., Chief, Department of Physical Therapy, The Protestant Episcopal Hospital,

S. B. HADDEN, M.D., Associate in Neurology, Temple University School of Medicine.

and

BARTGIS McGLONE, Ph.D., Assistant Professor of Physiology, University of Pennsylvania.

PHILADELPHIA.

212. Treatment of Hemiplegia.

SAMUEL ERNEST BILIK, M.D., Director, Physical Therapy, Bellevue and New Rochelle Hospitals.

NEW YORK.

Discussion: R. J. McMahon, M.D., Johnson City, N. Y.; H. D. Holman, M.D., Mason City, Ia.

213. The Rôle of Physical Therapy in Endocrine Disorders.

MAX A. GOLDZIEHER, M.D., Endocrinologist, Gouverneur Hospital; Pathologist, Kingston and Women's Hospitals.

BROOKLYN.

Discussion: Heinrich Wolf, M.D., New York; Henry H. Haft, M.D., Syracuse; John H. Ghormley, M.D., Albany.

214. Bio-mechanical Repercussions.

CHARLES MURRAY GRATZ, M.D., Instructor, Orthopedic Surgery, College of Physicians and Surgeons, Columbia University,

and

S. N. BLACKBERG, Ph.D.

NEW YORK.

Discussion: Benjamin P. Farrell, M.D., New York; Malcolm B. Coutts, M.D., New York; M. C. Beyer, M.D., Akron, Ohio.

SECTION ON HYDROTHERAPY

WEDNESDAY, September 9, 9 A.M.

Le Perroquet Suite, 4th Floor

OFFICERS OF THE SECTION

Chairman — John D. Currence, M.D., New York.

Secretary — B. S. Troedsson, M.D., Bryn Mawr, Pa.

221. Modern Hydrotherapy.

HANS J. BEHREND, M.D., Adjunct Physical Therapist, Hospital for Joint Diseases.

NEW YORK.

222. Vapothermia or Fever Treatment by Steam.

A. B. OLSON, M.D., Medical Staff, Battle Creek Sanitarium.

BATTLE CREEK, MICH.

223. The Physiologic Effect of Carbon-Dioxide Baths on the Circulatory System.

FRANZ M. GROEDEL, M.D., Director of the Kerchoff Heart Research Institute.

BAD NAUHEIM.

224. The Saratoga Spa.

WALTER S. McCLELLAN, M.D., Medical Director, Saratoga Springs Commission.

SARATOGA SPRINGS, N. Y.

Discussion: M. L. Lautman, M.D., Hot Springs, Ark.; Josef Nylin, M.D., Philadelphia; Euclid M. Smith, M.D., Hot Springs, Ark.; F. H. Ewerhardt, M.D., St. Louis; Heinrich Wolf, M.D., New York; S. A. Warshaw, M.D., New York

SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

WEDNESDAY, September 9, 9 A.M.

Jansen Suite, 4th Floor

OFFICERS OF THE SECTION

Chairman — R. A. Luongo, M.D., Philadelphia.
Secretary — Charles R. Brooke, M.D., Newark.

231. Relative Merits of Audiometric and Tuning Fork Tests.
MATTHEW S. ERSNER, M.D., Professor of Otology, Temple University School of Medicine.
PHILADELPHIA.

232. Electro-Acousto-Testometer for Accurate Timing and Recording of Bone Conduction Tests.
M. MARTYN KAFKA, M.D., Department of Otolaryngology, New York University Medical School.
NEW YORK.

Discussion: A. Spencer Kaufman, M.D. Philadelphia; Morris Levine, M.D., Brooklyn; Julius I. Klepper, M.D., New York.

233. Management of Bleeding Tumors of the Nose (Natural Color Microphotography Demonstration).
M. H. COTTLE, M.D., Attending Otolaryngologist, Illinois Masonic Hospital; Associate Otolaryngologist, Children's Memorial Hospital.
CHICAGO.

Discussion: J. Coleman Scal, M.D., New York; Ellis G. Linn, M.D., Des Moines, Ia.; H. E. Blanchard, M.D., Providence, R. I.; G. Allen Robinson, M.D., New York.

234. The Rôle of Physical Measures in the Treatment of Facial Paralysis.
OLIVER P. BOURBON, M.D., Attending Staff, California Lutheran and Methodist Hospitals.
LOS ANGELES.

Discussion: Frank Follweiler, M.D., Philadelphia; Farel Jouard, M.D., New York; Charles R. Brooke, M.D., Newark.

235. Electrosurgery—Its Indications and Limitations in Otolaryngologic Practice.
LEE COHEN, M.D., Rhinologist, Otologist, Sinai, and Baltimore Eye, Ear, Nose and Throat Charity Hospital.
BALTIMORE.

Discussion: R. A. Luongo, M.D., Philadelphia; G. P. Morison, M.D., Martinsburg, W. Va.; U. P. Horger, M.D., Taylor, Pa.; J. A. Haiman, M.D., New York.

SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

WEDNESDAY, September 9, 2 P.M.

Jansen Suite, 4th Floor

OFFICERS OF THE SECTION

Chairman — Frank Follweiler, M.D., Philadelphia.
Secretary — Cleon W. Symonds, M.D., Pasadena.

236. Bone Necrosis in Intraoral Cancer.
D. E. EHRLICH, M.D., Roentgenologist, New York City Cancer Institute, Department of Hospitals.
NEW YORK.

237. Accessible Neoplasms of the Head, Face and Neck.
A. F. TYLER, M.D., Attending Roentgenologist, St. Joseph and Immanuel Hospitals.
OMAHA.

Discussion: W. J. Thudium, M.D., New York; G. Allen Robinson, M.D., New York.

238. Further Experiences with the Electrocautery Treatment of Laryngeal Tuberculosis.
EDWARD A. LOOPER, M.D., Professor and Head of Department of Diseases of the Nose and Throat, University of Maryland College of Medicine.
BALTIMORE.

Discussion: Joseph W. Miller, M.D., New York; George E. Wilson, M.D., Saranac Lake; George B. McAuliffe, M.D., New York.

239. Physical Therapy as a Solution for Some Problems in Otolaryngology.
LEWIS J. SILVERS, M.D., Otolaryngologist, Ocean Hill Memorial Hospital.
NEW YORK.

Discussion: Benj. F. Tefft, M.D., West Warwick, R. I.; Edwin A. Griffin, M.D., Brooklyn; Henry L. Sinskey, M.D., Baltimore.

240. The Pharmacology of Inflammation.
MICHAEL G. MULINOS, M.D., Associate Professor of Pharmacology, College of Physicians and Surgeons, Columbia University.
NEW YORK.

Discussion: Louis Hirschhorn, M.D., New York.

SECTION ON GASTROENTEROLOGY

WEDNESDAY, September 9, 9 A.M.

Empire Room, Lobby Floor

OFFICERS OF THE SECTION

Chairman — James W. Wiltsie, M.D., Binghamton, N. Y.
Secretary — Cora Smith King, M.D., Hollywood, Calif.

241. Corrective Technique in Colon Therapy.
JOHN SEVERY HIBBEN, M.D., Consultant, Physical Therapy, Huntington Memorial Hospital; Staff, St. Luke's Hospital.
PASADENA.

Discussion: Samuel A. Warshaw, M.D., Brooklyn; N. Philip Norman, M.D., New York.

242. A Roentgen Consideration of the Colon.
LOUIS J. GELBER, M.D., Clinical Assistant to Dispensary, New York Post Graduate Hospital X-Ray Department.
NEWARK, N. J.

Discussion: B. I. Wulff, M.D., Binghamton, N. Y.; Charles S. B. Cassasa, M.D., New York.

243. Physical Therapy in Gastritis.
SAMUEL WEISS, M.D., Clinical Professor of Gastroenterology, New York Post Graduate Medical School, Columbia University.
NEW YORK.

Discussion: B. S. Troedsson, M.D., Bryn Mawr, Pa.; Solomon Weintraub, M.D., New York.

244. Colonic Irrigations in Cryptogenic Infections.
CLINTON D. HUBBARD, M.D., Staff, Suburban Hospital; Mission Hospital.
HUNTINGTON PARK, CAL.

Discussion: Marshall D. Hogan, M.D., Graystone Park, N. J.

245. Rationale of the Advance in Technique and Apparatus in Colon Therapy.
SAMUEL A. WARSHAW, M.D., Lecturer, Department Physical Therapy, Polyclinic Medical School and Hospital; Associate, Physical Therapy, Polyclinic Hospital.
BROOKLYN.

Discussion: G. L. Moench, M.D., New York; William Worster, M.D., San Gabriel, Cal.

GENERAL SCIENTIFIC SESSION

WEDNESDAY, September 9, 2 P.M.

Grand Ball Room, 3rd Floor

OFFICERS OF THE SECTION

Chairman — Norman E. Titus, M.D., New York.
Secretary — N. H. Polmer, M.D., New Orleans.

251. Therapeutic Application of Diathermy in Biliary Tract Disease.

HENRY A. RAFSKY, M.D., Associate Gastroenterologist, Lenox Hill and Beth Israel Hospitals.
NEW YORK.

252. Further Advances in the Obliteration of the Gall Bladder by Electrosurgical Procedure.

MAX THOREK, M.D., Attending Surgeon, Cook County Hospital; Surgeon-in-chief, American Hospital.
CHICAGO.

Discussion: A. David Willmoth, M.D., Louisville; George L. Schneider, M.D., Williamsport, Pa.; R. Zollinger, M.D., Boston; H. W. Hewitt, M.D., Detroit.

253. Electric Shocks: Their Causes, Incidence and Consequences.

DOUGLAS MACFARLAN, M.D., Clinic, Conservation of Hearing, Presbyterian Hospital.
PHILADELPHIA.

Discussion: Richard Kovács, M.D., New York; William W. Worster, M.D., San Gabriel, Cal.

254. Recent Developments in the Cinematography of the Fluoroscopic Image.

WILLIAM H. STEWART, M.D., Director, Radiology, Lenox Hill Hospital.
NEW YORK.

Discussion: Reuben Lavine, M.D., Syracuse; Charles B. Reed, M.D., Newburgh, N. Y.

GENERAL SCIENTIFIC SESSION

THURSDAY, September 10, 9 A.M.

Grand Ball Room, 3rd Floor

OFFICERS OF THE SECTION

Chairman — William H. Schmidt, M.D., Philadelphia.
Secretary — A. David Willmoth, M.D., Louisville.

351. Electrosurgery in the Treatment of Cancer, Pre- and Post-Radiation Therapy.

IRA I. KAPLAN, M.D., Director, Division of Cancer, Department of Hospitals.
NEW YORK.

352. The Rôle of Electrosurgery in Combined Treatment of Tumors.

ISABEL M. SCHARNAGEL, M.D., Assistant Attending Radiologist, Strang Clinic, New York Infirmary.
NEW YORK.

Discussion: A. F. Tyler, M.D., Omaha; Grant E. Ward, M.D., Baltimore; Gustavus M. Blech, M.D., Chicago.

353. Use of Electrical Amplifiers in Medicine, and Especially Physical Therapy.

GUSTAV BUCKY, M.D.
and
J. VON HORNBOSTEL, Ph.D., Research Department, New York University.
NEW YORK.

Discussion: William L. Cahall, M.D., New York; R. J. Reynolds, M.D., Potsdam, N. Y.; Solomon Goldstein, M.D., New York.

354. Treatment of Erysipelas with Ultraviolet Radiation.

J. G. JENKINS, M.D., Staff, Scott and Whitt Hospitals; Santa Fe R. R. Hospital.
TEMPLE, TEXAS.

Discussion: M. E. Knapp, M.D., Minneapolis; Norman E. Titus, M.D., New York; M. C. L. McGuinness, M.D., New York; S. Starr, M.D., Brooklyn.

355. Physical Measures in Traumatic Neurosis, Hysteria and Functional Nerve Conditions.

N. H. POLMER, M.D., Assistant Professor of Clinical Medicine, Graduate School of Medicine, Tulane University of Louisiana.
NEW ORLEANS.

Discussion: H. D. Holman, M.D., Mason City, Ia.; John D. Currence, M.D., New York.

GENERAL SCIENTIFIC SESSION

THURSDAY, September 10, 2 P.M.

The Sert Room, Lobby Floor

OFFICERS OF THE SECTION

Chairman — John Severy Hibben, M.D., Pasadena.
Secretary — Frank H. Walke, M.D., Shreveport, La.

356. Impaired Vasotone and Prospective Death.

C. WARD CRAMPTON, M.D., Chairman, Committee of Preventive Medicine, New York County Medical Society.
NEW YORK.

Discussion: Disraeli Kobak, M.D., Chicago; A. H. Hellman, M.D., New York; J. H. Irwin, M.D., Englewood, N. J.

SYMPOSIUM ON FEVER THERAPY

357. Historic Development and Modern Application of Artificial Fever.

UPTON GILES, M.D., Medical Director, Physical Therapy Department, Charity Hospital.
NEW ORLEANS.

358. Fever Therapy in Rheumatic Children.

LUCY PORTER SUTTON, M.D., Assistant Professor of Pediatrics, New York University; Associate Visiting Physician, Children's Medical Service, Bellevue Hospital.
NEW YORK.

359. Clinical Comparison of Malarial and Short Wave Therapy in Syphilis of the Central Nervous System. (Lantern Demonstration.)

JAMES K. HOWLES, M.D., Assistant Professor of Dermatology and Syphilology, Louisiana State University.
NEW ORLEANS.

Discussion: William H. Schmidt, M.D., Philadelphia. William Bierman, M.D., New York; F. H. Ewerhardt, M.D., St. Louis; Frank H. Krusen, M.D., Rochester, Minn.

360. A Consideration of the Elliott Treatment for Pelvic Inflammatory Diseases of Women.

LAWRENCE M. RANDALL, M.D., Section on Obstetrics and Gynecology, The Mayo Clinic, Rochester; Associate Professor of Obstetrics and Gynecology, The Graduate School, University of Minnesota.

and

FRANK H. KRUSEN, M.D., Section on Physical Therapy, The Mayo Clinic.

ROCHESTER, MINN.

Discussion: M. C. L. McGuinness, M.D., New York; William E. Ground, M.D., Superior, Wis.

GENERAL SCIENTIFIC SESSION

THURSDAY, September 10, 8 P.M.

The Sert Room, Lobby Floor

OFFICERS OF THE SECTION

Chairman — Richard Kovács, M.D., New York.

Secretary — M. C. L. McGuinness, M.D., New York.

361. Studies in Tissue Heating with Short Wave Diathermy.

JOHN S. COULTER, M.D., Associate Professor of Physical Therapy, Northwestern University Medical School; Member, Council on Physical Therapy, American Medical Association,

and

HOWARD A. CARTER, B.S. in M.E., Secretary, Council on Physical Therapy, American Medical Association.

CHICAGO.

362. Value of Ultra Short Wave Diathermy in Pyogenic Infections.

WILLIAM J. EGAN, M.D., Assistant Clinical Professor of Medicine, Marquette University School of Medicine.

MILWAUKEE, WIS.

Discussion: William Bierman, M.D., New York; William H. Schmidt, M.D., Philadelphia; David H. Kling, M.D., Los Angeles; Edward Horowitz, M.D., New York; D. Derow, M.D., New York; Samuel Gottesman, M.D., New York.

GENERAL SCIENTIFIC SESSION

FRIDAY, September 11, 9 A.M.

Grand Ball Room, 3rd Floor

OFFICERS OF THE SECTION

Chairman — Disraeli Kobak, M.D., Chicago.

Secretary — F. H. Ewerhardt, M.D., St. Louis.

401. The Treatment of Birth Injuries and Allied Problems.

EARL R. CARLSON, M.D., Neurologic Institute, Columbia University.

NEW YORK.

Discussion: Joshua H. Leiner, M.D., New York; Jerome Weiss, M.D., Brooklyn.

402. Effects of Heat, Cold and Other Stimuli Upon the Human Circulation.

FRED B. MOOR, M.D., Professor of Pharmacology and Therapeutics, College of Medical Evangelists, Loma Linda and Los Angeles, Cal.

LOMA LINDA, CAL.

Discussion: S. Bilik, M.D., New York; H. Herring, M.D., New York.

403. Present Status of Transurethral Prostatic Resection.

HU C. MYERS, M.D., Chief Surgeon, Myers Clinic Hospital.

PHILLIPI, W. VA.

404. Transurethral Prostatic Resection.

JOSEPH HYAMS, M.D., Associate Professor of Urology, New York Post Graduate Medical School, Columbia University.

NEW YORK.

Discussion: Juius J. Valentine, M.D., New York; Robert L. Ozlin, M.D., New York.

405. The Electrical Cutting Current in Proctologic Surgery.

I. MORTON BRENNER, M.D.

NEW YORK.

Discussion: Michael Canick, M.D., Brooklyn; Karl Zimmerman, M.D., Pittsburgh; W. J. Engel, M.D., Cleveland.

GENERAL SCIENTIFIC SESSION

FRIDAY, September 11, 2 P.M.

Grand Ball Room, 3rd Floor

OFFICERS OF THE SECTION

Chairman — Fred B. Moor, M.D., Loma Linda, Cal.

Secretary — Walter S. McClellan, M.D., Saratoga Springs.

SYMPOSIUM ON ARTHRITIS

411. Physical Therapy of Chronic Atrophic Rhinitis.

EUCLID M. SMITH, M.D., Instructor in Medicine, University of Arkansas.

HOT SPRINGS, ARK.

412. Postural Defects Related to Arthritis.

EDWARD F. HARTUNG, M.D., Assistant Professor Clinical Medicine, New York Post Graduate Medical School, Columbia University.

NEW YORK.

413. Arthritis of the Spine: Its Relation to the So-Called Rheumatoid Disorders.

MAURICE F. LAUTMAN, M.D., Director of the Department for the Study of Arthritis, Levi Memorial Hospital.

HOT SPRINGS, ARK.

414. Use of Air in Arthropathies.

HAROLD R. BOHLMAN, M.D., Instructor in Orthopedic Surgery, Johns Hopkins University Medical School.

BALTIMORE.

Discussion: William T. Johnson, M.D., Philadelphia; Charles Murray Gratz, M.D., New York; Samuel Ralph, M.D., Brooklyn; G. H. McKinstry, M.D., Washington, Pa.; Jacob Grossman; M.D., New York; Russell L. Haden, M.D.; Cleveland; John P. Stump, M.D., New York; P. W. Flagge, M.D., Highpoint, N. C.; Lloyd T. Brown, M.D., Boston.

CLINICS

SATURDAY, September 12, 9 A.M.

PHYSICAL THERAPY DEPARTMENTS

In Manhattan Hospitals

With Directors and their Times of Attendance

East Side — Bellevue Hospital, 26th St. and First Ave.
Dr. S. Bilik, dir. 9-12 daily.

Hospital for Ruptured and Crippled, 321 East 42nd St. (2nd Ave.).
Dr. K. G. Hansson, dir. 2-4 p.m. daily.

City Hospital, Welfare Island (via 59th St. Bridge).
Dr. R. Kovács, dir. 2-3 p.m. Thursdays.

Neurological Hospital, Welfare Island (via 59th St. Bridge).
Dr. H. Wolf, dir. 9-11 Tuesday.

New York Hospital (Cornell Med. Center) 525 East 68th St.
Dr. K. G. Hansson, dir. 10-12 a.m. daily.

Lenox Hill Hospital, 111 East 76th St. (Lex. Ave.).
Dr. M. C. L. McGuinness, dir. 10-12:30 Mon., Wed., Fri.

Mt. Sinai Hospital, 100th St. and Madison Avenue.
Dr. William Bierman, dir. 10-12 daily.

Joint Disease Hospital, 123rd St. and Madison Avenue.
Dr. Jerome Weiss, dir. 1-3 p.m. Tues., Thurs., Sat.

Manhattan State Hospital (mental) Wards Island (116th St. Ferry).
Dr. R. Kovács, dir. 2-3 Tuesdays.

West Side — Polyclinic Hospital, 335 West 50th St. (bet. 8th and 9th Ave.).
Dr. R. Kovács, dir. 10-11 daily.

Reconstruction Hospital, 100th and Central Park West.
Dr. H. Herring, dir. 9-11 Tues. and Thurs.

Presbyterian Hospital (Columbia Med. Center) 168th St. and Broadway.
Dr. Wm. B. Snow, acting dir. Mon., Wed., Fri. 9-1 p.m. Tues., Thurs. 1-5.

Downtown — Beekman Street Hospital, Pearl and Beekman Sts.
Dr. N. E. Titus, consulting. 10-1 Mondays.

Brooklyn — Kings County Hospital, Clarkson Ave., Brooklyn.
Dr. J. J. Hauff, dir. 10-12 Mon., Wed., Fri.
Dr. Frank Bradner, attend., 11-12:30 Tues., Thurs., Sat.

SCIENTIFIC EXHIBITS

Space No. 101

DR. FRED H. ALBEE, New York City.

It sets forth the mechanics both physiologic and biologic of the healing of a fracture of the neck of the femur. Exhibit will consist of x-rays showing the end results used in securing active stabilization of the hip and union in fracture of the neck of the femur, with special emphasis placed on the treatment of those cases in which aseptic necrosis of the head occurs.

Space No. 102 and 103

AMERICAN MEDICAL ASSOCIATION, COUNCIL ON PHYSICAL THERAPY.

Activities of the Council, e.g., education, Handbook on Physical Therapy, posture, and short wave diathermy.

Space No. 104

AMERICAN PHYSIOTHERAPY ASSOCIATION.

Analysis of the exercise treatment of the foot. Exhibit showing significant points in the kinesiology of the foot; analysis of foot exercises; contraindications for the use of certain foot exercises; demonstration of foot exercises.

Space No. 105

AMERICAN REGISTRY OF PHYSICAL THERAPY TECHNICIANS.

Charts of data showing requirements for certification; standards of education and training of technicians.

Space No. 106 and 107

AMERICAN SOCIETY FOR THE CONTROL OF CANCER.

Wax models and charts on cancer.

Space No. 108

DR. WILLIAM S. BAINBRIDGE, New York City.

Lantern slides demonstrating the functioning of the enlarged and improved Physical Therapy Department of the United States Naval Hospital, Brooklyn, New York, immediately following the World War and continuing. From this beginning physical therapy was spread throughout the Naval Hospitals in the United States, and this department was used as a model for many other institutions.

Space No. 109

DR. WILLIAM BIERMAN, New York City.

Temperature studies in the living human subject in regions of muscle, subcutaneous tissue, skin, pelvic tissues and paranasal sinuses.

Space No. 110

DR. WILLIAM BIERMAN, DR. E. A. HOROWITZ, New York City.

Treatment of gonorrhea in the female by means of systemic and additional pelvic heating. Drawings and micro photographs of cervical and urethral discharges indicating the conditions before and subsequent to the use of hyperthermia.

Space No. 111

DR. GUSTAV BUCKY, DR. F. VON HORNBOSTEL, New York City.

Photographs of cases (Grenz ray treatments; measuring devices).

Space No. 112

DR. M. H. COTTLE, Chicago.

Natural color microphotography of bleeding tumors of the nose.

Space No. 113

DR. C. WARD CRAMPTON, New York City.

Space No. 114

DR. JOHN D. CURRENCE, New York City.

Motion pictures, charts, model — hydrotherapy in arthritis.

Space No. 115 and 116

DR. CHARLES MURRAY GRATZ, DR. S. N. BLACKBERG, New York City.

Summary of bio-mechanical studies of fibrous tissues. Histological and anatomical studies of fascia and fascial adhesions. Instruments for fascial transplantation and for pneumofasciagrams. Pneumofasciagrams of apparently normal patients and also rheumatic patients.

Space No. 117

DR. K. G. HANSSON, New York City.

Study in vital capacity; small model and charts.

Space No. 118

DR. EDWARD F. HARTUNG, G. V. AMMERMULLER, A.B., New York City.

Diagnosis and treatment of postural defects related to arthritis.

Space No. 119 and 120

DR. MORTIMER N. HYAMS, New York City.

A new method of transuterine occlusion of the uterine cornu under direct vision with a special high frequency current.

Space No. 121 and 122

DR. DISRAELI KOBAK, Chicago.

Demonstration of the action of ultraviolet light on living and non-living material (organic and inorganic), including fluorescence and its detection in science, commerce and the arts.

Space No. 123 and 124

DR. RICHARD KOVACS, New York City.

Physical therapy instruction, charts and models.

Space No. 125 and 126

DR. GEORGE M. MacKEE, DR. ANTHONY CIPOLLARO, New York City.

Cutaneous tuberculosis and tuberculides; colored photographs with explanatory charts.

Space No. 127

DR. WALTER McCLELLAN, Saratoga Springs, New York.

Diagrams and charts showing the nature of mineral waters found in the United States. Clinical study of patients treated at the Saratoga Spa.

Space No. 128

MARY C. MERRITT, New York City.

Finished articles from Occupational Therapy Department, Department of Hospitals, City of New York.

Space No. 129

DR. HAROLD NEIFELD, Brooklyn, New York.

Effects of physical agents on schematic circulation.

Space No. 130

NEW YORK PHYSICAL THERAPY SOCIETY.

Historical apparatus and accessories.

Space No. 131

DR. VAL PARMLEY, Little Rock, Ark.

Compression fractures of the vertebrae; specimens, films, etc.

Space No. 132

POST GRADUATE HOSPITAL VASCULAR DISEASE CLINIC.

Mecholyl iontophoresis in the treatment of varicose ulcers, Raynaud's disease, scleroderma. Action of short wave on the local and general circulation.

Space No. 133

DR. SIMON L. RUSKIN, New York City.

Central and vegetative innervation of the nasal accessory sinuses.

Space No. 134 and 135

DR. RAPHAEL SCHILLINGER, Brooklyn, N. Y.

Roentgenograms of nasal sinuses for purpose of comparing diagnostic value of (a) simple standard roentgen examination; (b) examination with radiopaques, paying particular attention to a study of the time element necessary for evacuation of the opaque from the sinus, whereby an index of physiologic activity of the sinus mucosa is established; clinical and operative data; microscopic pathologic changes.

Space No. 136

DR. EUCLID SMITH, DR. CHARLES H. LUTTERLOH, Hot Springs, Ark.

Management of chronic arthritis in the Hot Springs Arkansas Spa; x-ray pictures, case histories; motion pictures.

Space No. 137

DR. JEROME WEISS, Brooklyn, N. Y.

Original model of flasher sinusoidal apparatus loaned by the Hospital for Joint Diseases; also board mounted models.

TECHNICAL EXHIBITS

ADLANCO X-RAY CORPORATION.

Will show the various models of the ORIGINAL ULTRATHERM and the unique Schliephake Glass Condenser Electrodes for Ultra Short Wave Therapy.

You should not miss this opportunity to look over the equipment used by Schliephake, Liebesny, Diffenbach and by many thousands of prominent physicians.

AMPEREX ELECTRONIC PRODUCTS, INC.

ARCHIVES OF PHYSICAL THERAPY, X-RAY, RADIUM.

The various ways in which the ARCHIVES can prove helpful to the general practitioner and specialist will be shown in an instructive display.

BARR LABORATORIES, INC.

Short wave apparatus; orificial electrodes with compensator for high pelvic temperatures; orificial cold quartz sinus electrodes; treatment stand; monopolar electrosurgery with single knob control.

J. BEEBER COMPANY.

Large array of physical therapy and x-ray apparatus. The featured product will be the new multiple wave Fischertherm and the new Mattern motor driven Fluorexograph. These units reveal the latest scientific developments; a revelation in this type of equipment.

BLAIR & CURTIS, INC.

The new Cinquarsen Powdex Method (Powdex Insufflator and Cartridges) for trichomonas vaginitis, now improved so that even obstinate recurrences are relieved.

BURDICK CORPORATION.

A complete line of physical therapy equipment. Features of especial interest will be the new Triplex Short Wave Diathermy Unit and the Suction-Pressure Therapy Apparatus for the treatment of peripheral vascular disease.

CAMERON SURGICAL SPECIALTY COMPANY.

The very latest development in electrically lighted diagnostic instruments. New diagnostic sets for your Boston bag in a wide variety of prices. The Cameron Cauterodyne in a new and inexpensive model for cutting and coagulating in office and ambulatory surgery will also be shown.

COMPREX-OSCILLATOR CORPORATION.

Do not fail to see the precision built Wappler Electromedical equipment, displayed and demonstrated by qualified attendants. The complete Comprex line includes short wave diathermy units, Comprex Radio Knife, a comprehensive line of cautery transformers, including the original "Pistol Grip" cautery handle, cystoscopic and thorascopic instruments and accessories.

THE COWARD SHOE, INC.

Here you will find a display of sensible light weight walking shoes and dress shoes, the outgrowth of 70 years effort to build fine footwear. From the vast assortment our counsellor can select one for the individual foot of your patient. This method of shoe fitting is the next step to custom measuring, the price of which prohibits mass prescription. We are always ready to cooperate with the medical profession in filling prescriptions for perfectly balanced footwear.

DIERKER CORPORATION.

Dierker Therapeutic Apparatus for administering treatments and medication to accessible cavities; reprints of scientific papers by eminent clinicians dealing with this method of therapy.

ELECTRO THERAPY PRODUCTS CORP., AND THE E. J. ROSE MFG. CO.

While in New York we earnestly solicit your registration at our booth or Factory Office, enabling us to acquaint you with the present and future developments in LIGHT, HEAT and EXERCISE.

FANGO CORPORATION OF AMERICA.

Fango di Battaglia, Italian mineral clay used in Carlsbad, Baden-Baden, Vienna, is being demonstrated for the first time in America.

H. G. FISCHER & COMPANY.

Feature several new units of apparatus: A Shockproof Fluoroscope — wall model; a new eye, ear, nose and throat specialist's cabinet, combined with a short wave unit; a cabinet model short wave apparatus that affords use of cuff, pad, and orificial electrodes, also the inductance cable. In addition there will be a complete line of x-ray and electrotherapeutic units in new designs and models.

GENERAL ELECTRIC X-RAY CORPORATION.

In conjunction with an exhibit of modern physical therapy devices (including the famous Inductotherm and Hemolator), an illuminated photographic presentation of the subject of Inductopyrexia, showing a new technical procedure which materially simplifies the production of artificial fever.

HANOVIA CHEMICAL & MANUFACTURING COMPANY.

Complete line of new ULTRAVIOLET and RADIANT HEAT LAMPS. Also, for the first time, exhibit and introduce the newest types of ULTRA SHORT WAVE THERAPY UNITS.

HAROLD SURGICAL CORPORATION.

A full line of physiotherapy apparatus, physician and hospital supplies, including furniture, stainless steel and diagnostic instruments. A feature of the display will be a complete line of low priced ultraviolet ray lamps.

HELEN HECHMAN.

Gaseous Foam Bubble Baths and Internal Foam Therapy are late additions to hydrotherapy, and deal with the dispersion of gases, to attain light atmospheric pressures. The foam is a live network of physical charges, a harmony of speed, rhythm and atoms which are to be adjusted to suit the physiology and personality of the patient.

HIGH TENSION CORPORATION.

Among the equipment to be exhibited will be Model RF-5, Short Wave Unit, Model RF-1, Portable Short Wave, H. T. C. Vapotherm Cabinet for Controlled Aseptic Fever and its full line of Electro Surgical Equipment.

C. COY HONSAKER.

The latest equipment in hydrotherapy, as embodied in the Honsaker Colonic Lavagatory, for cleaning and treating the colon and the Honsaker Hydro-Eneciator, for inducing fever. Induces fever, controls fever and distributes fever safely.

ILLE ELECTRIC CORPORATION.

Will display the Burdick line of Physical Therapy Equipment; also several new pieces of modern hydro-therapeutic equipment including the Titus Portable Hydro-Massage Whirlpool Bath.

PAUL E. JOHNSON, MANUFACTURER.

Exhibit of combination short and ultra short wave therapy units which embody electrosurgery that operate WHOLLY FREE FROM CARBONIZATION, with greatest smoothness and less cell destruction than heretofore obtainable. Also a full line of high quality physical therapy equipment so moderately priced that every physician can afford to purchase a complete equipment.

LEPEL HIGH FREQUENCY LABORATORIES, INC.

Ultra-short wave machines and quartz-mercury ultraviolet lamps for general, local and orificial irradiation. The Lepel ultra-short wave machine embodies in the one unit, currents for the application of five valuable modalities, and is worthy of the consideration of doctors wishing to equip their offices with modern physical therapy equipment.

LIEBEL-FLARSHEIM COMPANY.

Demonstration of the L-F Short Wave Generators. The three different models available afford a wide selection. With one, two and three methods of application and power output from 200 to 500 watts — there is a unit offered for every purse and purpose. Flexible and powerful units recommended for general therapeutic use. The well-known BOVIE Electro-Surgical Units will also be exhibited.

MEDELECTRO PRODUCTS CORPORATION.

Short and Ultra-Short Wave Equipment of standards dictated only by the latest and most advanced engineering and medical principles are offered to the profession.

MERCK & COMPANY, INC.

Mecholyl by iontophoresis for the treatment of chronic leg ulcers and the peripheral vascular diseases. Attendants will gladly give full information regarding the remedy and the technic of administration and will, upon request, arrange for practical demonstrations.

PHILIP MORRIS & COMPANY, LTD.

Demonstration of method by which it was found that Philip Morris cigarettes, in which diethylene glycol is used as the hygroscopic agent, are less irritating than ordinary cigarettes in which glycerine is employed.

McINTOSH ELECTRICAL CORPORATION.

Complete line of physical therapy equipment and accessories. It will include the Hogan Brevatherm Short-Wave Diathermy Unit, office model; the Hogan Brevatherm, clinic model; and the Hogan Super-Brevatherm Short Wave Diathermy Unit, hospital model. The McIntosh Biolite Infrared Generators, the McIntosh Junior Metro-Coagulator, the McIntosh Standard, Universal, and Mobile longwave diathermy units will also be shown.

C. V. MOSBY COMPANY.

Complete line of medical books and medical journals.

NATIONAL CARBON COMPANY, INC.

A complete line of newly designed Eveready Professional Model Carbon Arc Units will be exhibited and demonstrated. A few principles of carbon arc operation giving very high ultraviolet emission are used in the latest Eveready Professional Model A-2 Lamp and in the recently developed portable two-cot unit.

PEERLESS ELECTRIC COMPANY.

Equipment for short wave therapy, permitting dosage predetermination and control, with friction clutch treatment arms requiring no hand-locking devices. Mercury-quartz ultraviolet equipment permitting adjustment for short, (bactericidal) or full (tonic) range spectrum, operates from any of their short wave models, which, with their low volt apparatus, is designed to meet the requirements of the physician or hospital.

PROMETHEUS ELECTRIC CORPORATION.

A complete line of physical therapy and medical equipment featuring durability of construction, efficiency of operation, and appealing designs. Among the many items included are operating lights, infra-red lamps, sterilizers, examining lamps.

PYREXON RAY CORPORATION.

The pyrexon applicators, the insulated, infra-red "bakers" produce a diffuse, penetrating, mild heat. Features are saefty, greater efficiency, low cost and the ultimate in simplicity because of their special construction. Applicators available in three sizes; body model for induction of artificial fever.

RADIUM EMANATION CORPORATION.

A wide variety of applicators used in modern radium therapy including composite leak-proof Radon seeds, loading slot implanting instruments, intrauterine tubes, cervical applicators, and surface plaques. The REC Ultra Short Wave, 6 meter, 400 watt Diatherm will also be demonstrated at this booth.

SANITAX ELECTRIC COMPANY.

Will exhibit the latest important gas type short wave apparatus as well as tube machines, 15 meter, 150 watts; 15 meter, 275 watts; 15 meter, 350 watts; 9 meter, 350 watts; 6 meter, 400 watts.

THERMOHALE, INCORPORATED.

Thermohale modernizes inhalation therapy and obtains the maximum value out of heat with medication in the relief of hay fever, asthma, colds and sinus infections.

TREATMENT REGULATOR CORPORATION.

Elliott Treatment Regulator circulates a constant supply of hot water through anatomically-shaped Latex applicators. Applicators are evenly distensible and when inserted in orificial body cavity fill cavity entirely, radiating heat evenly and uniformly. Pressure and temperature are under physician's control so patient suffers no discomfort. Temperature of 120 degrees F. can be continuously maintained.

VITAMIN PRODUCTS COMPANY.

Information on "V-P" Vitamin Concentrates: a full set of Vitamin News, a monthly publication issued for the last three years discussing concentrated vitamins and how you may use them.

WAITE-BARTLETT X-RAY MFG. COMPANY.

New model and design — short wave unit will be shown for the first time in the display at this session.

THE WALK-AIDER.

For exercise and comfort this is a radical change in invalid chairs. Gives real aid to the physician and independence to patient — allows mobility — muscle training — and coordination with important feature of safety — inspires confidence — adaptable as stretcher.

DEVELOPMENT OF SHORT WAVE THERAPY *

ERWIN SCHLIEPHAKE, M.D.

Dozent at the University of Giessen, Chief Physician of the Balser Foundation (Balserische Stiftung)

GIESSEN, GERMANY

Part II

ULTRASHORT WAVE THERAPY

The expositions in the first part have shown sufficiently that in ultrashort wave therapy we are not dealing with heating effects in the common sense, as is still being asserted by some authors, but with a heat which often deviates from that of thermotherapy and diathermy. The proof for this was attained by me in my first therapeutic experiments. It was by a sheer accident that I began in 1929 the treatment of furuncles. Because of the then unknown dangers I did not dare to apply my experimental experiences gained in two years to patients. I embraced the opportunity of an affliction with a nasal furuncle for an experiment on myself, which resulted in a complete success. By this for the first time proof was established that ultrashort wave therapy actually is a method of treatment *sui generis*, for the ordinary diathermy, as is well known, is contraindicated in acute inflammation.

Encouraged by the success, I have since then treated hundreds of furuncles with virtually the same success. The average duration of treatment, which we needed for the cure of even long standing furuncolosis was four and one-half days, in large carbuncles 10-14 days. Incisions were required only exceptionally. The same results were obtained by Liebesny, who has cured about 60 furuncles of the upper lip solely with short wave therapy. Egan reports an average duration for cure of 3-4 days, and Ruete had similar experiences. The bad results which are still reported by a very few authors are evidently due to incorrect dosage.

It goes without saying that it was not our sole aim to treat furuncles, and we soon undertook the treatment of extensive suppurative processes. Observation of the course in furuncles had shown us in what manner the effect of the short wave field takes place. If the inflammatory process is recent and the infiltrations are hard, the process can often be restored to normal without leaving a trace. If on the other hand there is already present softening of the tissues, the process is accelerated and the separation of the necrotic material is furthered. We made important observations in the very beginning of our investigations with diseases of the mouth and of the teeth. At first we treated *periodontic irritation* which in some cases had existed for some time, with good success. These successes have recently been confirmed by Heise on a large number of patients. It is striking how rapidly such infiltrates and suppurative processes respond to short wave therapy and often become cured as early as after the fourth or fifth seance. Osteomyelitic processes of the jaw show accelerated sequestration and accordingly a reduction of the curative period. Similar good results were had in perimandibular periostitis, infiltrations of the floor of the mouth, lymphadenitis as well as inflammatory and suppurative parotitis. Even in long drawn out cases of gingivitis and stomatitis cures often were attained after 6-8 radiations.

The reports on paradentosis (alveolar pyorrhea) differ. I myself have treated in collaboration with dental surgeons a large number of cases of variable character and in at least two-thirds of the cases attained a complete suc-

* Translated from the German by a Member of the Editorial Staff.

cess. This group had predominantly inflammatory or degenerative phenomena. Beyond any doubt, as was also confirmed by other authors, in all cases there was a regression of the inflammation, suppuration and of the infiltrates. Beyond this we saw in the majority of the cases an improvement of the circulation and through it of the degenerative phenomena. The looseness of the teeth improved gradually and eventually we succeeded in getting them to be fixed perfectly in their alveoli. The gum assumed a rosy, fresh appearance, but bleeding of the gums continued for some time. Heise, on the other hand, states that only the inflammatory but not the degenerative processes have been influenced. To be sure the concerned authors employed a technic which I have rejected, namely, the treatment with so-called flexible electrodes covered by rubber. The difference in the therapeutic result may furthermore be sought in the employment of different type of apparatus and wavelengths, as some of the work has been done with spark gap apparatus. It is certainly possible that triode tube and spark gap apparatus exert different effects on such processes.

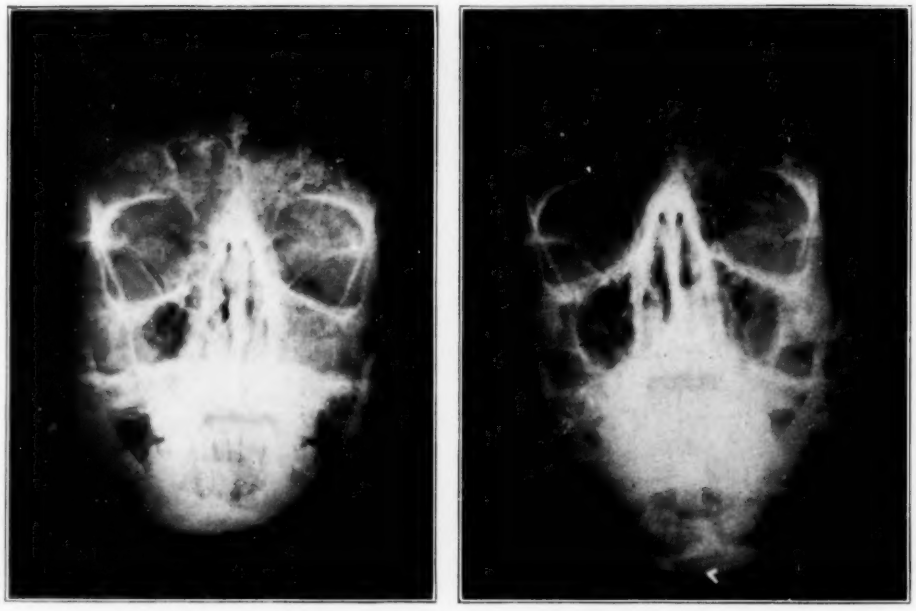
A very important problem is that of the treatment of dental granuloma. We know today the importance of these granulomas as sources of focal infection and their possible complications. Unfortunately our first hopes of a successful attack on the granulomas with short waves have not been fully realized, but we can utilize the short wave to augment the conventional dental treatment with good effect. A therapy solely with short waves in cases of granuloma is bound to be a failure because ordinarily a new infection of a prolonged character takes place through the root canal. However, we are in a position to support the conservative dental treatment through the root canal with the short waves and to accelerate the healing process. For this we need very short wavelengths, between 3 and 4 meters. In this field short wave therapy has still another value. Repeatedly we have suspected in acute rheumatic affections that there may be present focal infection in the teeth. After short wave radiations at the site of the rheumatic pains and muscular indurations had proved fruitless, we instituted treatment of the teeth and observed afterward disappearance of the rheumatic troubles. This improvement, however, did not last very long, the pains returned a few weeks after stopping the radiation, but we had a guide to the seat of the focal infection and ordered the guilty teeth to be extracted. In this connection Oertel's observations are of interest. He radiated the bacteria in the interior of the teeth and in most cases greatly damaged the germs.

A similar situation exists if the focal infection is in the tonsils or in the accessory nasal cavities (figs. 1 and 2). We are in position to save patients from extraction of teeth and tonsillectomy in cases they are not absolutely indicated. The short waves have in these cases a value for diagnosis *ex juvantibus* and for the enhancement of the conservative and surgical treatment of teeth.

After the successes with small and localized suppurative processes I turned my attention to empyema of the pleural cavities. Here it was possible objectively to demonstrate by precise data and pictures what the short waves can accomplish. It is solely by such proofs that the subjective moment can be excluded, which plays a more or less important rôle in other cases. I submit that all patients who had been treated by me for empyema of the pleura or for abscess of the lung have been checked by other physicians throughout the courses and roentgenograms were made before, during and after the treatment. The patients were not at all selected according to some point of view, but were given treatment without selection as they came in. This factor should be taken into consideration in relation to surgical therapy, as only a limited number of patients are suitable for operative therapy.

In order to facilitate visualization I present a few case histories.

Case 1. — Mrs. M. W., aged 56, came under my care on November 17, 1935. She had suffered from cough for the past four weeks and was very weak. Since eight days there is fetid



Figs. 1 and 2. — Empyema of the antrum, of several years duration (Left); after four weeks' treatment (Right).

expectoration, she has sharp pains in the right side of the chest, cough, pronounced sense of misery and a rise of temperature up to 39 degrees C. (102 degrees F.). The roentgenogram (fig. 3) shows an extensive shadow throughout the entire right upper and center field, with large cavitation below the clavicle.

Short wave treatment with 6 meter wavelength was instituted at once for 5 minutes, which period was increased from day to day until 20 minutes were reached. After the first radiations there was a rise of the temperature, but better general feeling. After 8 days the roentgenogram remains unchanged, but the expectoration is not as malodorous. The sputum contains hemolytic streptococci.

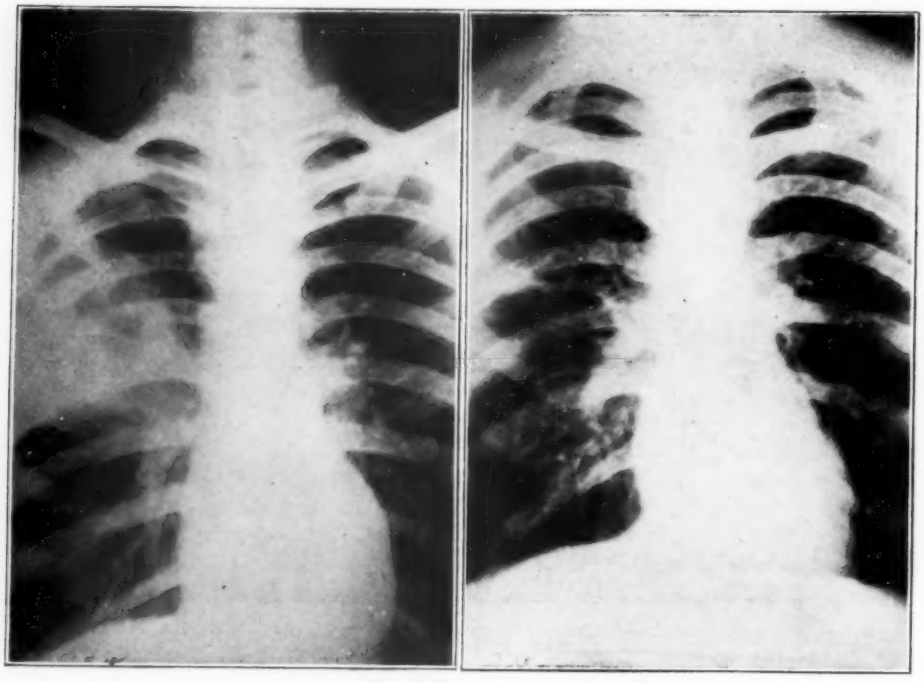
After 14 days the temperature has receded, but is still not normal (fig. 4), the shadow in the roentgenogram has become brighter throughout (fig. 5). After 4 weeks the temperature is normal, the patient feels much stronger and walks unaided to the treatment room. The cough is less, attacks coming on but rarely, at which some purulent sputum is brought up. After 6 weeks there is still a diffuse blurring in the right upper and center field, the patient feels well and leaves the bed. She no longer complains, the appetite is good, and her weight has increased (fig. 6).

We have here to deal with an extensive process with pronounced surrounding infiltration. The cause cannot be determined with absolute certainty, but the history indicates a grippe infection, which was rampant at that time. There is no doubt that there was a malignant progressive process. Complete coughing up was out of the question considering the small quantities of the sputum.

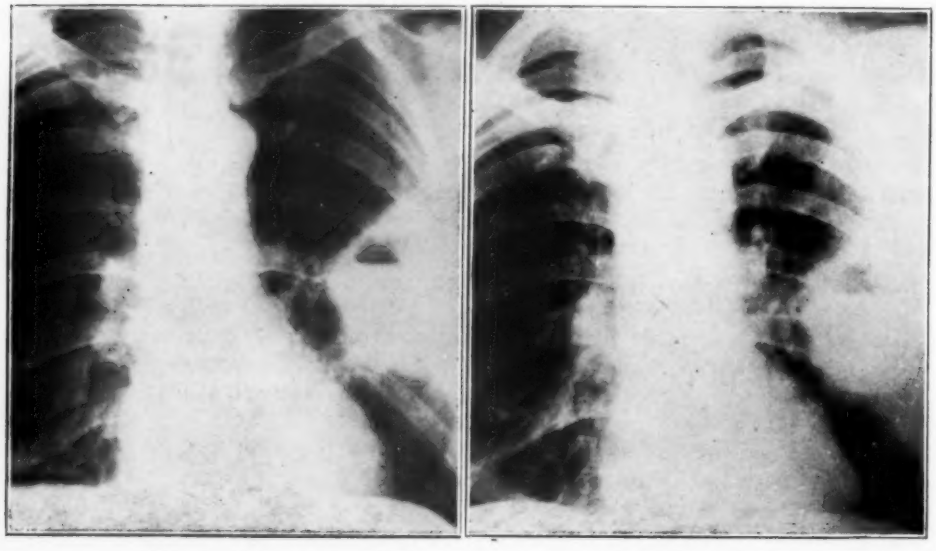
Case 2. — William St., agriculturalist, was seen by me in November, 1934, when bronchiectasis was diagnosed. Towards the end of 1935 he underwent a rib resection for empyema in the surgical clinic of Giessen. This was followed by residual empyema, bronchial fistula and an intensely suppurating external fistula. Temperature was not elevated. Short wave treatment was instituted December 2. The roentgenogram shows a large infiltrate in the center and the lower field. A few spots are due to injections of iodipin. There is a suppurating fistula in the left chest, the breadth of a hand above the diaphragm.

After about 6 radiations subjective improvement. Suppuration of the fistula is lessened, breathing is easier. After 20 treatments the fistulae, the external as well as the bronchial, are completely closed. Increase in weight. After 8 weeks discharged cured (figs. 7 and 8).

Case 3. — Johanna Fr., aged 63, had in April, 1935, a cholecystectomy, after which she did not recuperate. There remained a fistula which excreted constantly. Three weeks later fever above 102 degrees F. Fluoroscopy shows a limited transverse dense shadow above the right diaphragm in the middle of the lower field, which extends to the hilus. Diag-

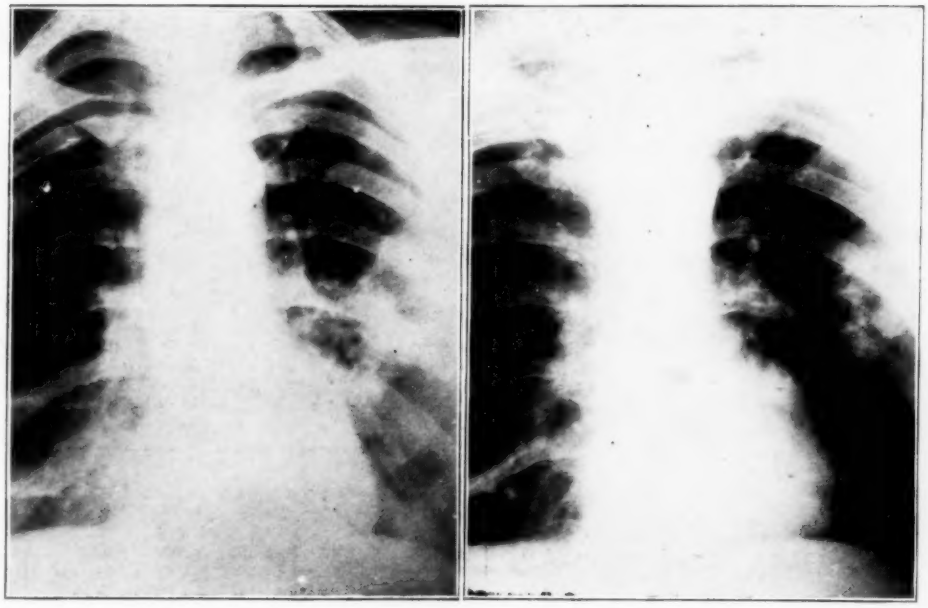


Figs. 3 and 4. — Gangrenous interlobar empyema with abscess formation; Cachexia (Left); the same patient, discharged cured after six weeks (Right).



Figs. 5 and 6. — Lung abscess with high fever due to influenza (Left); after four weeks' treatment (Right).

nosis: Lung abscess produced by continuity from a pericholecystitis. Radiations every second day for 20 minutes with the pyrotherm at 12 meter wavelength, and distance of plates at 20 centimeters at both sides. (The large distance of the plates was necessary because of enormous obesity of the patient.) The bodily temperature receded considerably after 6 radiations, but there still remained subfebrile rises of temperature. After 10 seances the roentgenogram shows a pronounced regression of the phenomena there being left only a narrow line-like shadow. The general condition was greatly improved, the sense of misery gone. In the operation wound in the right upper abdomen



Figs. 7 and 8. — The same patient (figs. 5 and 6) after four weeks (Left), and after eight weeks (Right).

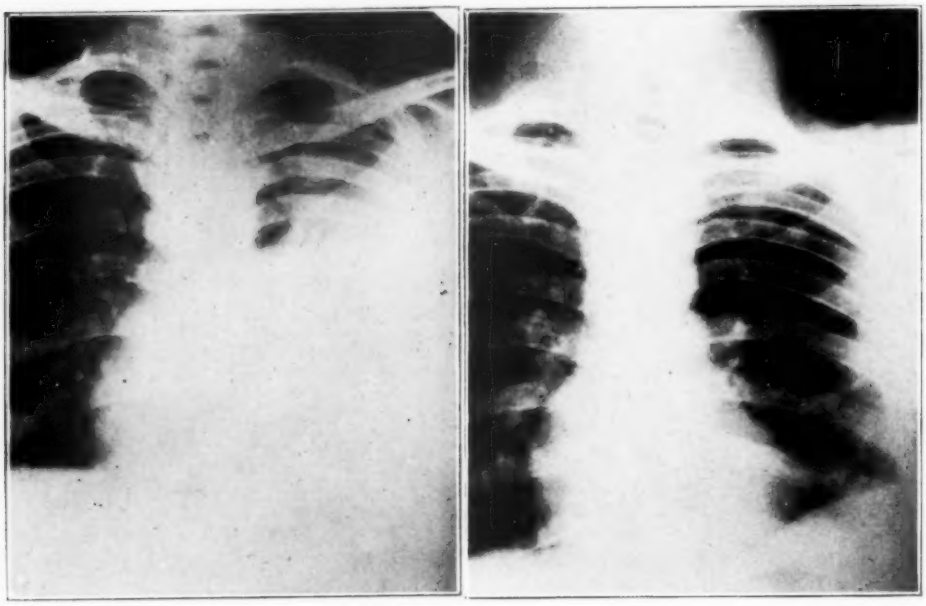
meanwhile appeared an infiltrate, which after a few additional treatments fluctuated and evacuated pus. The findings of the lung gradually retrogressed and the patient could be discharged after about 6 weeks of treatment. She remained free of trouble (figs. 9 and 10).

Case 4. — Sa., gardener, aged 28, was referred to me in March, 1935, by the medical clinic of Giessen for short wave treatment. He has had a cough with sputum for a considerable time, especially during the forenoon. Since the spring season the temperature rose gradually and there was increase of the pussy, fetid sputum. Pains in the left chest. The roentgenogram showed a shadow of the entire left thorax, numerous spots of deeper shadow indicating abscesses. Bronchography revealed grave bronchiectasis. The heart and large vessels are pushed to the left.

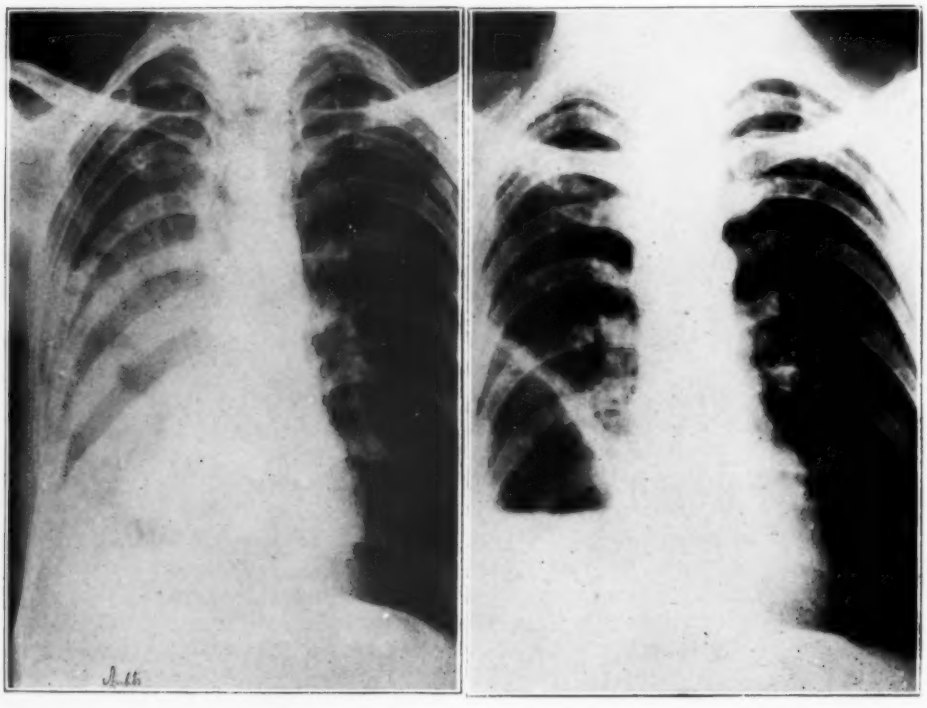
Treatment with the pyrotherm at 12 meter wavelength, beginning with weak energy for 5 minutes and increasing the energy and the time period to 3 minutes with the plates at great distance spacing.

After 10 radiations the general condition is considerably improved, the temperature declined, but is still subfebrile. The patient is discharged from the clinic as partly improved. Requested to report later, he appeared a few weeks after his discharge with the temperature at 100 degrees F. He suffered from pronounced shortness of breath and fetid expectoration. The roentgenogram reveals the fact that there is still a shadow of the left lung, part of the shadow showing spots. Radiations with the pyrotherm are now given twice weekly. After a few radiations the condition is greatly improved, the fever has disappeared and the patient can resume his work. The roentgenogram shows merely a veil-like blurring. The striking feature of this case is that in spite of the pronounced displacement of the heart and the large blood vessels and the resulting embarrassment of the circulation we obtained such a success (figs 11 and 12).

I have selected from my material the above cases as illustrations of the effect of the short wave field on this kind of process, but they are by no means isolated ones. Until now I have treated 40 patients with severe pleural empyema, lung abscesses and suppurative pneumonia with and without gangrene. All these patients have been cured. In only two was there need of intervention. One was a child, aged 10, with a large postpneumonic pleural empyema, whose temperature had been normal for eight days under short wave therapy. Aspiration was performed because after three weeks of treatment the roentgenogram showed no diminution of the shadow. In another patient whom we had treated for a tuberculous empyema with mixed infection, a rib resection was performed. In



Figs. 9 and 10. — Acute post-pneumonic empyema (Left); and after two months (Right).



Figs. 11 and 12. — Empyema in a tuberculous patient, the infection mixed with pneumococci, and with formation of multiple abscesses (Left); the same patient after ten weeks (Right). The remaining exudate was finally evacuated by aspiration.

this patient after four weeks of treatment the shadow had largely disappeared, but there remained a spread out exudate at the lateral thoracic wall, which was completely evacuated by the rib resection.

In addition to these two cases, four others have to be mentioned because short wave therapy remained unsuccessful. I group them here separately because the lung conditions appeared as complications of other diseases. Two of these patients came under my care with the diagnosis of lung abscess. The condition became aggravated so that I had to stop treatment. After the lethal end postmortem examination revealed that bronchial carcinoma was the cause of the abscess.

No success was had in the case of a 16-year-old girl with a large suppurative empyema of the pleura. The empyema resulted from suppurative peritonitis of appendiceal origin that had broken through the diaphragm into the chest cavity. In this case only a miracle could have saved life. Finally we had a lethal issue in the case of a 22-year-old girl who had undergone radical extirpation on account of suppurative adnexitis. There developed pelvic peritonitis, sepsis and finally a lung abscess.

I believe that one cannot refer to short wave therapy as a failure by such cases, especially because even surgical intervention was out of the question. These cases can therefore be properly excluded, but even if we do include them we still have 90 per cent of cures in the treated cases, which, I repeat, have not been selected. Let us now consider the end result of lung abscess without short wave treatment. According to the reports of European and American authors there is a mortality of 60 to 75 per cent, that is, more than two-thirds of the patients die under conservative treatment. But even with surgical intervention the mortality is still high, it being given as 35-40 per cent. In addition, another factor has to be taken into consideration. Surgical intervention is possible only in such patients whose abscess can be reached from without. The operation is mutilating, as a large part of the chest wall has to be removed. Furthermore, the postoperative care requires a long time, often months.

In contrast to all this, short wave treatment presents to the patient no other inconvenience than his transportation, the treatment itself being described by him as pleasant. There remain no serious changes in the chest or ribs except a slight induration, as has been amply demonstrated by roentgenograms. After their discharge the patients are again normal beings.

For a long time my results have been the only ones. Even Liebesny, to whom we are so much indebted in the domain of short waves, has at first doubted them. But after Liebesny had accepted my technic (apparatus of large output, large distances of separation of the electrodes, great field intensities) he was in a position wholly to confirm my results. He has now a large number of cases. Further confirmations are published by Fiandaca, who at the April, 1935 session of the Accademia Medica Lombarda showed photographs of cured lung abscesses; by Dieffenbach in New York, and von den Welden in Berlin (personal communication). The successes of short wave therapy of suppurative diseases of the lungs are today undeniable. Failures most often are ascribable to inadequate apparatus and incorrect technics. In addition to purely suppurative diseases of the chest cavity we have repeatedly treated chronic pneumonia, and in these cases, too, we had decidedly good results, even in cases in which previously other measures had failed. Pulmonary tuberculosis will be discussed in connection with other tuberculous affections as a separate article. Here we record that excellent results from treatment were obtained in infiltrative and exudative processes of the lung and pleura after infection with Bacillus abortus Bang and Malta fever. Though these infiltrations are very stubborn and cannot be prevented from extension by any remedy, we saw after short wave therapy rapid regression first of the subjective complaints and shortly after also of the

objective findings. Often 10 to 12 radiations during 10 to 14 days sufficed to produce complete disappearance of the changes.

There is hardly need emphasizing the effect of the short waves on dry pleuritis and mild infiltrative processes, such as localized bronchopneumonia, on which a general favorable influence was effected. In cases of chronic bronchitis, too, radical improvement is attained in a short time by short wave therapy. The quantity of expectoration ordinarily diminishes even after a few treatments and finally disappears entirely.

A group by itself is bronchiectasis. Here the results are not uniform. In mild cases we repeatedly obtained a healing of the inflammatory bronchitic phenomena and of the bronchopneumonia. A complete cure of the disease is not possible. According to our present-day concepts a cure is a priori improbable, as constitutional factors which can hardly be influenced play a great rôle. Nevertheless, we were able to afford the patients even in progressed stages essential relief, and that when all other means had proved powerless. Our therapy, in the light of what has been said, is to be regarded as purely symptomatic in character.

Inflammatory and catarrhal processes of the upper air passages represent a large field in which short wave therapy is indicated. Cases of chronic laryngitis for which inhalation and bath treatments had proved useless, were often cured by a few seances, so that the hoarseness disappeared entirely. A simple cold in the head often can be aborted within a few hours, and even chronic rhinitis can be cured in most instances.

Concerning the treatment of tuberculous diseases of the respiratory tract nothing conclusive can yet be presented, as the material has been small and the results have not been uniform. Nevertheless it seems that proliferative and caverno-cirrhotic types are favorably accessible. In the evaluation of the past results it must be emphasized that virtually all patients who have been treated were of a type in which every other therapy is hopeless. Evidently in less grave cases no one has risked short wave therapy as yet.

Schedtler observed in 14 treated cases with tuberculosis of the lungs accompanied by attacks of pleuritis (dry) with rise of temperature, much pain and respiratory embarrassment, considerable improvement of the complaints. One to two seances sufficed to relieve the subjective symptoms. In all cases without exception the symptoms abated in a short time, even in the cases in which other remedies had proved futile. The temperature, too, became normal after a few sessions.

Exudative pleurisy also can be favorably affected in most cases, as I have shown on a previous occasion by pictures. Naturally one must not figure on rapid results, 20 to 30 radiations being required. The best plan is thoroughly to empty the exudate before beginning the treatment. In six patients in whom the exudates reaccumulated after repeated aspiration, Schedtler observed four times good success with 5 and 6.50 meter wavelengths. He obtained complete resorption of the exudate with subsequent induration. It was striking that the end results were favorable in that the dreaded contraction of the affected side remained minimal.

Short wave therapy of laryngeal tuberculosis is still in the initial stage, but it may be stated that the results of our treatment employed in collaboration with Dr. Arold have been favorable, but it is stressed that proper indication must be determined and the right dosage applied.

There are some favorable results reported by authors, especially by Dausset, with the treatment of bronchial asthma. The treatment may be administered during the periods free from attack. As a rule the attacks come less frequently and their reappearance may lastingly be prevented by continual short wave therapy. According to my experience the attacks return when the treatment is

stopped. The successes of the therapy cannot be regarded as conclusive, since psychic factors also play a rôle.

Abdominal Diseases

In various abdominal conditions advantageous use may be made of the short waves, and we often may favorably influence such patients for whom little or nothing may be accomplished with surgical procedures. An especially good field is presented by inflammatory adhesions, which appear after operations or peritoneal affections and cause the patients great trouble. They not only result in disagreeable pains which migrate in the abdomen, but there appear spasms and tenesmus, indigestion and constipation. Operative interventions produce only temporary improvement, new adhesions often following any operative procedure.

All authors who have employed short wave therapy or short wave diathermy in such cases agree in their reports that improvement or complete removal of the complaints is achieved within a few days. The pains disappear, evacuation of the bowels is regulated and the general condition is, as a rule, considerably improved. In chronic appendicitis, too, considerable improvement and removal of the complaints may be achieved. At least short wave therapy should be given a trial in all cases in which operation is not urgent, as properly applied, harmful effects are not to be anticipated.

Healing effects have been reported in acute progressive peritonitis! Haas and Lob report several cases of postoperative peritonitis following perforative appendicitis and perforated gastric ulcer in which prolonged individual treatments caused a disappearance of the symptoms.

Chronic and acute gastritis may be favorably affected. Patients often report that the pains in the gastric region, eructations and nausea disappear in a short time.

In ulcer of the stomach and duodenum we, as a rule, do not employ short wave therapy. I consider this therapy absolutely contraindicated in acute ulcers. The intense hyperemia created by the treatment and which may remain for hours, increases the danger of hemorrhage. In other observations, too, I have seen no convincing improvement in acute ulcer. In fact, we have at our disposal a much better remedy in the form of the spleen substance—Prosplen. In older cases of ulcer with formation of callus and inflammatory adhesions and in periduodenitis on the other hand, short wave therapy may have a favorable effect, manifested by the abatement of the subjective symptoms, the pains, sensitivity to pressure and nausea. We also saw in such cases a recession of the muscular defense and of the palpatory findings in callous ulcers of large size. Short wave therapy in general is solely an adjunct to the usual ulcer treatment.

Few experiences have been gathered with diseases of the intestine. In two cases of ulcerative colitis I saw considerable improvement, but these few cases are not presenting conclusive evidence. Schedtler states that short wave therapy is capable considerably to improve or even remove the symptoms produced by intestinal tuberculosis. However, one will scarcely assume that the anatomic processes of intestinal tuberculosis can be cured. In peritoneal tuberculosis the short waves seem to exert a favorable influence. At any rate, we may say that research in this field is still in its infancy. Nothing conclusive can now be given, and it will take years until we will know the optimal conditions of treatment and the exact indications.

Complaints due to hemorrhoids offer a favorable field for the short waves. Naturally it is impossible to remove the hemorrhoidal nodes, this being achievable only by operation. But the complaints of the patients often are not ascribable to the nodes but to the inflammatory infiltrations of the anal ring around the nodes, which cause painful defecation. These phenomena in most cases can

be removed by 6 to 10 short wave radiations. It happens that after operation the inflammatory processes continue to exist and to cause trouble. Here, too, a few radiations will bring help.

Diseases of the liver, according to the experience gained so far, appear to be suitable for short wave therapy, especially diffuse hepatitis. But cirrhosis of the liver, too, appears to be responsibe to the short waves. A grave case of liver disease is the following:

CASE 5. — A painter consulted me for a grave hepatitis, for which he had been in hospitals for several years. The disease, however, had progressively become worse. The course was such that on an average of two times per week fever to about 39 degrees C. appeared with great prostration and swelling of the liver. In the intervals too the liver overlapped the costal arch by 15 centimeters. It had an uneven surface and a hard consistency. There was intense icterus with acholic feces. During the free intervals there was subfebrile temperature. In addition, the patient had a grave diabetes which required the daily administration of 100 units insulin.

Treatments of great energy were given for 20 minutes daily. As early as after a week the color of the feces improved. The temperature was not as high and the patient remained sugar free with only 80 units of insulin. After 14 days the fever disappeared. The liver was considerably reduced in size and extended over the costal arch only by the width of a hand. Ascites, which had been present before, disappeared. The general condition was much improved, and the previously bedridden patient was able to travel to his home unaided. He remained well for half a year when rise of temperature reappeared. The patient then went elsewhere for short wave treatment, and in a short time the temperature and the general condition again became normal. The icterus had completely disappeared even after the first course of treatment.

The course in another patient not only plainly shows the effect of the short waves on the diseases of the liver, but also the differentiated effect of diverse wavelengths.

CASE 6. — A woman, 50 years of age, suffered for the past four years from an uncontrollably progressive disease of the liver, accompanied by intense icterus. There was a moderate ascites, the liver extended beyond the costal arch by 20 cm. Feces were completely acholic. I began treatment in this condition when other physicians had given up the patient. We initiated the treatment by radiating the region of the liver with a 6-m wavelength 20 minutes daily. As early as after a week success was noted because the feces had assumed a brown color. Swelling of the liver and the ascites regressed. After four weeks the icterus had been reduced to a light subicteric coloration of the skin. The patient was able to resume her duties as housewife.

About half a year later the patient consulted me for the old complaints. The feces had again become acholic, and there was also a slight degree of ascites. This time I employed for purely technical reasons a 12 m. wavelength. Although the energy yield was much greater, we saw no success, not even after four weeks of treatment. The patient then demanded to be treated again with the old apparatus and wavelength. We acceded to her request and were not a little astonished to see that after three radiations the feces again assumed normal color and the icterus disappeared gradually. The patient is now in a relatively good condition, but must take a course of treatments every six months. Though a complete cure is perhaps impossible in the progressed stage when treatment was first undertaken, we nevertheless succeeded in prolonging life and rendering it tolerable.

Cholecystitis in most cases responds well to short wave therapy. Cases without calculi are especially suitable. The diagnosis may be supported by duodenal drainage and the absence of the gallbladder reflex and the presence of numerous leucocytes in the bile. In addition, we fall back on cholecystography when the bladder does not become filled by the dye or does not contract after consumption of the yolk of an egg. The subjective phenomena of pain and sense of tension disappear often after a few radiations. Many of the patients under my care have till now, after two years of observation, shown no recurrence. Such successes to be sure are attainable only when there are no gallstones. In several cases with calculi I was able to afford alleviation, but have advised operation.

In pancreatitis, too, the short waves should be given a trial. There is a prospect of success, as is shown by a case reported by Haas and Lob.

Gynecologic diseases have aroused great interest. Here we have a large future field once we have learned to make better use of diverse wavelengths

and dosage. The differences in the reports of various authors shows clearly enough the influence of various technics and methods of treatment. Like elsewhere here, too, it is a matter not of apparatus but of the physician. The first reports in this domain are by Raab, who has seen a favorable effect in inflammatory tumors of the adnexa as well as acute suppurative processes in the small pelvis.

Other authors have reported on the favorable effect especially on acute processes. It appears that it is particularly acute and chronic pelvic peritonitis that presents a suitable field for short wave therapy, because often there results a recession of the fever, symptoms and of the objective findings in a very short time. In 1932 I observed the following case:

Case 7. — A woman, aged 20, had been infected by her husband with gonorrhea, which soon was followed by a violent, acute, pelvic peritomtis. Operation was rejected by the attending gynecologist on account of the extent of the disease and the poor condition of the patient. After 4 treatments with a 6 m. wavelength the temperature sank and the general condition improved. After 12 treatments within four weeks the gynecologic condition had become reduced to an extent that permitted the patient to be discharged. Three months later we learned that she had remained free from any complaint.

Siedentopf, of the Leipsic gynecologic university clinic, has reported several cases of acute inflammation of the adnexa. I am citing the following case taken from his contribution:

Case 8. — Mrs. K. H., aged 32, nullipara, has been treated since 1921 for gonorrhea and syphilis. For the past three days she suffered in connection with her menses from fever, backache and pains in the abdomen. She was admitted December 10, 1934, with the diagnosis bilateral pyosalpinx. An exact physical examination was impossible on account of extreme sensitivity to pressure. In spite of rest in bed, ice bag and extensive resort to narcotics, the condition did not show any improvement on December 18, on which day the patient was given the first short wave radiation. There appeared at first an increase of her pains, but on the following day the patient reported that she felt "excellent." Three days later she arose, and after 7 short wave radiations, she was discharged clinically cured, December 28, 1934. The surprising feature of this case was the course of the temperature. On admission she had 38 degrees C. (101 degrees F.), then an increase to 39.4 degrees C. (104 degrees F.). With the exception of one remission the temperature hovered at about 39 degrees C. (103 degrees F.) in spite of rest in bed and the ice pack. The day following the first short wave treatment there was a sudden drop to normal, which continued without recurrence.

In parametritis the acute cases seem to react well, while the chronic cases can be influenced somewhat more slowly. Here I report only one of the cases treated by me and studied also by the attending gynecologists:

Case 9. — E. P., aged 37. Menstruation began at the age of 21. She had one birth and one miscarriage. Since 1921 she suffered from a stomach affection, appendectomy in 1926, two gallbladder operations in 1927 with another operation of the biliary duct in 1928. In 1929 she suffered from peritonitis and two years later made an attempt at suicide. Towards the end of September, 1932, she suddenly developed abdominal pains with a temperature of 39,5 degrees C. (104.2 degrees F.). She was first treated with compresses and then subjected to laparotomy. Carcinoma of the sigmoid was suspected. Since July, 1932, the patient had suffered from irregular menstruation and menorrhagia. The patient bled almost continually and had an uninterrupted serosanguinous discharge. Since the operation the menses were regular, but she suffered from abdominal pains, insomnia and poor appetite.

Gynecologic examination revealed a full, anteflexed, fixed uterus, the right parametrium thickened and increased to the size of a goose egg. January 20, 1933 was given the first short wave treatment which was repeated twice weekly. One plate was placed over the sacrum and the other, with a diameter of 20 cm. over the abdomen. On January 30 the patient reported pronounced relief of her symptoms. She sleeps and eats well. February 4, 1933, the uterus was found to be still "full" and anteflexed, but movable. The right parametrium is still somewhat thickened and sensitive to pressure, on the left side there was a swelling the size of a hen's egg. February 14 the patient had gained one pound, and 6 days later was recorded a constant gain in weight of the previously cachectic woman. In the left side of the abdomen the pain has disappeared while on the right side she occasionally experiences slight pain. Gynecologically, the patient at that time showed no essential change on examination (menstruation due).

February 26, gynecologic examination revealed considerable improvement. There was no longer any sensitivity to palpation, and only slight thickening of the parametria. Considerable increase in weight. After a total of 20 radiations the patient was discharged as considerably improved.

I am citing another case reported by Siedentopf:

Case 10. — Mrs. L. V., aged 23, 1-para. Gives a history of gonorrhea with abdominal inflammation. The patient was admitted December 14, 1934, to the clinic because of intense pains in the right lower abdomen and in the back. Examination, which was very painful, revealed a movable, retroverted uterus of normal size, at the right of which was palpated an extremely sensitive tumor of the size of a hen's egg. Diagnosis: Right-sided pyosalpinx. The patient was permitted to pass her menstrual period and was then given 10 short wave radiations. There appeared a temporary rise of temperature to 38.5 degrees C., which, however, could be attributed to a cold and pharyngitis. The pains disappeared. On discharge, January 8, 1935, examination showed absence of sensitivity to pressure, with the uterus anteflexed and movable. There was no trace of the right sided inflammatory tumor. The receiving and discharging physician, who had examined the patient also on admission, reported a brilliant improvement, objectively as well as subjectively.

Siedentopf emphasizes in accord with my views the extraordinary importance of the problems of proper apparatus for the therapy of gynecologic affections. He at first treated 33 patients with a small spark apparatus of 12 m. wavelength. With this he secured improvement in only 6 cases and an exacerbation in one case. When a more efficient, larger apparatus of 6 m. wavelength was utilized, the results were far better. In all cases the pains and sensitivity to pressure disappeared, while objectively only 2 failures were experienced. Accordingly, as I have pointed out from the very beginning, dosage and wavelength must play a rôle, and perhaps also the type of apparatus. Of importance naturally is the employment of the proper electrodes and of a suitable skin electrode distance.

I have repeatedly observed in chronic parametritis and in diseases of the adnexa an initial exacerbation of the affection, as is evidenced by the above descriptions. There may appear a considerable increase of temperature associated with swelling of the parts. I also saw quite often the premature appearance of the menses. These phenomena are at first somewhat alarming, but I have never seen a propagation of disease or harm for the patients' health, nor were such reported by other observers. These initial exacerbations of gynecologic diseases are in contrast to our experience with other suppurative diseases, as indeed, similar observations were made only occasionally in osteomyelitis.

Still better results may be anticipated by the more extensive use of vaginal electrodes, by which a more concentrated treatment of the adnexa is possible. To be sure the application of these electrodes presupposes an especially good technic and familiarity with the peculiarities of the short wave field. If the hopes in this domain should be realized many a woman will be spared mutilating operations.

So far as the problem of osteomyelitis is concerned, alas no progress can be reported owing to the limited interests in surgical circles, although precisely this field is a very promising one. How often have patients come to us with a record of 10 to 20 operations without the least success! It goes without saying that for the treatment of such patients much patience is required, for an immediate success must not be anticipated. Just as with surgical therapy, one will have to figure on failures, but the consequences are not as grave as those following operation. I, myself, have had occasion to treat but a few patients with osteomyelitis. With few exceptions these were grave, chronic cases that had undergone several operations. A few among them were war injuries. It is impossible to present a definite conclusion on such limited material. My impressions gained so far I would reservedly formulate to the effect that in about half of the cases subjective

improvement and functional amelioration took place. In some cases there was a slight initial exacerbation of the processes, which in one case hindered motion. Apparently sequestration and demarcation were favorably influenced, so that sometimes sequestra are spontaneously thrown off. In other cases in which operation for the time being was inadmissible because of the extent of the process, short wave therapy resulted in the formation of sequestra which could easily be removed by operation. It is desirable that systematic experiments with various wavelengths be carried out in osteomyelitis.

Of diseases of the male sexual organs we mention orchitis and epididymitis, in which other authors and I have seen excellent results from short wave therapy. Especially striking is the rapid disappearance of pain and other subjective complaints, but the swelling, too, subsides in a surprisingly short time. Reports on the results of treatment of male and female gonorrhea are so contradictory that further observations should be awaited.

Little is known today about the short wave treatment of diseases of the kidneys. I saw a cure within a very short period in a case with a paranephritic abscess, which developed after rupture of the kidney with subsequent suturing. Fever and suppuration disappeared in 8 days. The patient, a 9-year-old boy, could be regarded as cured after four weeks. There are no published reports on acute nephritis. According to Rausch, of Budapest, in chronic nephritis a certain improvement of symptoms appears to be attainable, and above all the blood pressure becomes lowered.

In cystitis and pyelitis the results have not been uniform. With local short wave therapy my results have been virtually nil, on the other hand splendid results were obtained with electropyrexia directed predominantly to the abdomen. For this very efficient apparatus with electrodes large enough to cover the entire belly are absolutely essential. With them we attain in the majority of cases an abatement of the pains and spasms after 3 to 4 seances. After 8 to 10 seances the urine is free from leucocytes and epithelia. To be sure, one has to figure on recurrences in these cases, so that often several series of radiations are required. Here I should add that in the cases treated by me, we dealt with chronic cases of long duration that had previously been treated with different remedies without success.

Of interest is the description of a case by Liebesny, who has seen considerable improvement in urogenital tuberculosis from short wave therapy. As the case is a singular one, it is mentioned only.

We have frequently resorted to short wave therapy in cases of prostatic hypertrophy and prostatitis. One best makes use of special electrodes which are introduced into the rectum. They are not in immediate contact with the oscillatory circuit, but have the object of concentrating the field lines on themselves and thence to the prostate. Especial experience is essential for the proper application of these electrodes. Usually we saw after 10 to 12 seances disappearance of the sense of pressure and improvement in the act of micturition. In a few cases we were able after the termination of the course to establish that the prostate had become softer and smaller.

Diseases of the Vascular System

Diseases of the heart and blood vessels represent a special group in short wave therapy. According to the presentations in the first part of this article on the effects of the short waves on the blood vessels, it must be assumed that the short wave field possesses especial vasotropic effects, which vary according to dosage and wavelength. The yield of the apparatus, kind and distance of electrodes, arrangements of the electrodes and applied energy are factors fundamentally affecting or changing the results of treat-

ment. In the main the effects are to be reduced to the reactions of the capillaries and the arterioles. One, for example, can visualize a dilatation of the vasa vasorum of the wall of the aorta, and through it an improvement in the nutrition of the entire vessel.

Few reports have been published on the treatment of endocarditis, but they encourage further trials. The disease evidently has recently become so rare that it was impossible to collect any experiences. Considering the bad prognosis, the short waves should be at least tried, in all cases of endocarditis. In damage of the myocardium, especially in chronic myocarditis, the short wave method has proved of value. It is self-evident that one will not at once initiate short wave treatment in patients with decompensation, but first induce compensation by drugs. Then short wave treatment may be given with the electrodes placed over the chest and the back. We often see patients who become enabled to resume work and get along without cardiac remedies.

In angina pectoris one often attains gratifying amelioration. It hardly needs stressing that the treatment must be initiated with very weak doses. The excitement of patients due to facing a new and unknown method of treatment, often provokes attacks, which are improperly attributed to the short wave therapy. I, myself, have never seen any unpleasant accidents during radiations for angina pectoris. To be sure I am present during the first treatment. One will naturally not expect patients with grave, progressed coronary sclerosis to be freed of attacks. But in cases that have not progressed too far, one may attain a considerable abatement of the gravity of the attacks, and even complete freedom from them, so that one will have to take into account the need for repeating the courses of treatment from time to time.

The high blood pressure of essential hypertension can be considerably improved by general treatment of the entire body with weak doses. The subjective symptoms often become diminished even after a few treatments.

Endocrine Disturbances

Jorns has assumed an inhibitory influence of ultrashort waves on the activity of the thyroid gland, and this has been confirmed recently by Last, on the basis of a large number of experiments. He saw in animals a pronounced decrease of the colloid and a shrinking of cells after radiation with a 4 m. wavelength. The interesting part is that the same result was not attainable with wavelengths of 15 m. To what extent this effect can be utilized for the treatment of Basedow's disease cannot yet be determined, for there is need of a large material. The few cases I have treated until now do not permit a definite opinion.

According to Dausset short wave radiation appears to have a favorable effect on dystrophia adiposogenitalis. Sexual activity does not appear to be essentially affected, at any rate the first dreaded unfavorable influences have not been realized. In my experimental animals I have seen only normal procreation, provided they were not treated with excessive doses.

Conclusion

Today we have experimental proof that ultrashort waves may produce effects which are not to be regarded as due to heat in the common sense of the word. Heat is irregular motion of all molecules in a warmed area, but in the short wave field we have regulated motion of definite particles and groups, and these are dependent on wavelength. With very short waves we are in the domain of selective effects.

The clinical observations support this concept, for we see effects which

cannot be explained as due to general heating. To be sure we have not yet the possibility to span bridges everywhere between the experimental findings and the clinical results. We do not as yet know the rôle each of these effects plays in the healing process.

A furuncle heals occasionally also by hot compresses, but in the short wave field it becomes cured in a much shorter time, and with a development of heat so little that we are unable to measure it. When, on the other hand, the field strength is so great that stronger heating takes place, we observe a worse process of healing than with a lesser energy. We do not know whether these effects are due to dissociation of ions, to changes in the density of the membranes, or to other causes, and we will be able to elucidate the problem only after long drawn out investigations. At any rate we are facing a large problem which it is worth while to cultivate.

FANGO PACKS IN THERAPY *

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Mud-packs for inflammatory disorders have long been in vogue on the European Continent. Most large hospitals and institutions are equipped for these treatments. The "Fango Kuranstalt" in Vienna is devoted exclusively to this purpose. The mud generally used is called *Fango di Battaglia,* so named after its source, and physicians practicing abroad are familiar with its indications and varied technics.

Several months ago Fango became available here and ours was the first hospital to use it in America. We found it to be in the same form as when we used it abroad and equally efficacious.

Fango, as just alluded to, is the Italian name for the extremely fine deposit which settles at the bottom of several lakes, situated at Battaglia in northern Italy. The lakes are fed by hot springs, volcanic in origin, issuing from the mountain of St. Helena. The volcanic mineral matter can be seen continually coming to the surface, carried by small bubbles of gas, which burst and allow the infinitely small particles to sink to the bottoms of the lakes. Here they accumulate as a gray deposit, which is Fango. The real birthplace of these particles is the volcanic crater from which the water flows.

The use of Fango di Battaglia for therapeutic purposes is mentioned by Pliny, Galen, Joh. de Dondis, Savonarola, and others. The Roman emperors built magnificent marble baths at Battaglia, but these were destroyed during the great migration of nations, and only restored by Theodoric the Great. This ancient health resort has maintained its reputation down to our times and sends its product into distant parts of the world.

Therapeutic Value

The therapeutic value of Fango with regard to the alleviation of certain ailments and diseases, has been established by experiments made over a long period of years at many famous European hospitals and clinics. While it was first brought to notice by the cures it effected during the ages when medical treatment was in its infancy and it was the custom to endeavour

* From the Physical Therapy Department of the Hospital for Joint Diseases.

One of the five steaming lakes at Battaglia from which Fango is obtained.

to cure various ailments by nature's own remedies, it has maintained its position because of its scientifically demonstrated value.

The material is smooth and plastic and has no odor. In contrast to peat it is free from gritty particles, roots and wood fibre, and is soft and velvety to the skin. After each application it is easily removed by a warm spray, leaving the skin in a clean condition. Fango is customarily used but once for hygienic and esthetic reasons.

The Fango pack has the thermo-mechanical effect of a warm wet compress, an application always recognized as an alleviator of pain and affords all the advantages of moist heat. It is more penetrating, soothing and relaxing than dry baking. It is an ideal compress, for it adheres so closely that there is no possibility of air being interposed between the compress and the skin. The specific heat of the mud is high and its thermal conductivity is low, the temperature thus being maintained for a long time, dropping only a few degrees in two to three hours.

Fango treatments are usually given in the form of a partial or full pack, directly to the affected part of the body. It would of course be possible to immerse the whole body, but this method is not advisable as mud-baths exert a great strain on the circulation. In most instances the local application is sufficient. For a rheumatic knee, for example, the leg from mid thigh to the ankle is enveloped in a thick layer or "Pack."

After the Fango is applied the various coverings are wrapped firmly and quickly around the patient in order to induce a good hyperemia and if desired a general perspiration. The temperature and the duration of the packs vary, according to the stage of treatment and the condition and nature of the case. The temperature of the mud, its consistency, the application of the pack, its duration and the after treatment must be determined by the physician.

High temperatures can not always be conveyed to the body. The reaction of the circulatory system being complicated, the application often has to be given at a low temperature to produce the desired vasodilatation. With old or weak patients tight wrapping-up should be avoided to prevent excessive perspiration. These treatments can be employed with patients

of all ages and of every constitution, even with those who suffer from heart affections.

Chemical Constituents

Part of the efficacy of Fango is undoubtedly due to its chemical qualities, because of its content of sulphur, iron, silicates, and its radioactivity. The mass of this very adjustable material exerts a pressure on the part of the body it covers. This mechanical action most probably leads to osmotic changes in the skin and supports the softening, resolving, and resorbing of pathologic products. These mobilized inflammatory products and toxins get into the body tissues and produce reactions, similar in character to those caused by protein shock therapy. Reactions of such nature caused by stimulation and irritation of the skin organ are now the center of medical interest.

Many scientific explanations are given in the foreign literature of the therapeutic value of Fango packs in inflammatory disorders. We therefore may be permitted to refer to a few cases of a different nature which have been treated here with mud packs, to illustrate the results obtained and to outline the indications.

Case 1. — N. L. Age 54. Male, white. Dupuytren contracture treated by resection of the palmar fascia. When the wound was healed, the fifth finger of the right hand was in complete flexion. When he was referred to the Hydrotherapy Department, the palm of the right hand was so indurated that with his second, third and fourth finger he could make only an incomplete fist. After 19 mud-packs the palm became so loose that amputation of the fifth finger was considered. This was done and three weeks later the patient was referred for further treatments. He now received eight Fango packs to his right hand and made an excellent recovery. The palm of the right hand is now absolutely soft and the patient is able to make a complete fist and to use his right hand normally. This encouraging result influenced the orthopedic service (Dr. Finkelstein) to initiate the same method of treatment for the left hand.

Case 2. — P. K., female, white. Presents a history of an infected finger followed by lymphangitis. When patient was referred for treatment she complained of severe pains and loss of function of the right forearm. Examination showed numerous healed scars on all aspects of the hand and wrist. There was subluxation and prominence of the ulnar styloid. Motions were almost completely restricted as the result of a fibrous ankylosis involving the wrist and all joints of the hand. The fingers were maintained in a position of rigid extension, thumb in abduction. The x-ray diagnosis was: recent pyarthrosis, possibly early osteomyelitis lower end of the ulna. After only a few mud-packs the severe pain began to disappear. Patient was then treated with 30 mud-packs, with the result that she was able to flex the fingers to about one-half of the normal range. Extension was possible to within 85 per cent of the normal, the thumb function at the proximal joint about one-half, at the distal joint about one-fourth of the normal. The severe pain disappeared entirely. It then became possible to do something to improve the apposition of the fingers.

Fango packs are of great value in the treatment of rheumatic disorders (sciatica, neuritis, lumbago, rheumatoid and osteoarthritis). We observed a rapid absorption of effusions, relief of pain and increased mobility of stiff joints. The packs are also valuable for the after-treatment of traumatic bone and joint diseases, for relief of the congestion incident to parametritis and other gynecologic conditions, and they have been successfully used for the treatment of orchitis and epididymitis. In these latter cases the soft and warm Fango packs prove particularly grateful to the patient.

It is evident from what has been said how indispensable it is that the patient undergoing Fango treatment should be under the physician's close observation, and how necessary it is to individualize treatment. It is our opinion that Fango packs form an essential part of physical therapy and should be accorded a definite place in modern therapeutics.

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TEMPERATURE OF SKIN SURFACE

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Part II

Skin Temperature for Differentiation of Organic Occlusion and Vasospasm

Observations of changes in skin surface temperature of the toes in differentiation between vasospasm and organic occlusion have been made by several men. It has been shown that the removal of the sympathetic vasoconstrictor influence caused an elevation of the skin surface temperature of the extremities where vasospasm existed, but not where an occlusive organic process was the cause of the vascular difficulties.[41] It has been noted that there normally occurs a rise in the skin surface temperature of the toes during the induction of general anesthesia (fig. 15).[42] This reaction has since been used as a test to distinguish

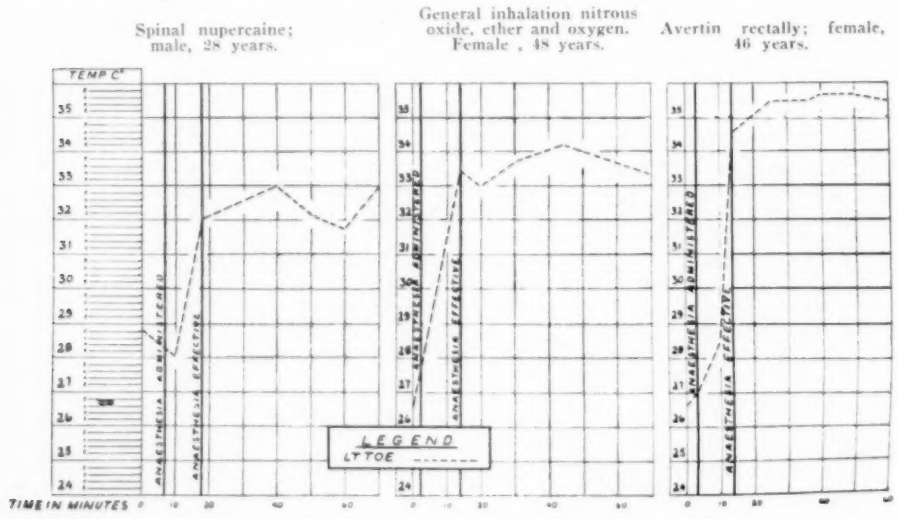
Spinal nupercaine; male, 28 years.
General inhalation nitrous oxide, ether and oxygen. Female, 48 years.
Avertin rectally; female, 46 years.
TEMP C°
TIME IN MINUTES
LEGEND
L TOE

Fig. 15. — Effect of anaesthesia on normal peripheral circulation.

between occlusive vascular disease and vessel "spasm." Several workers have found that if during the performance of a surgical operation the skin surface temperature of the extremities rises not at all or very little or declines secondarily, then the prognosis for the recovery of the patient is poor.[43, 44] It has been shown that if satisfactory rises in the surface temperature of the involved extremities are not observed after the induction of general anesthesia, an additional rise will not develop after interruption of the sympathetic enervation by ganglionectomy.[45] The creation of systemic fever by intravenous typhoid injection causes an elevation of the skin surface temperature of the extremities when the spasm factor rather than occlusive vascular disease exists.[46] In 1930 it was shown that it was possible to differentiate between vasospasm and organic occlusion by means of spinal anesthesia.[47] In the same year attention was directed to the possibility of making this differentiation by blocking the region of the sympathetic ganglia with procaine.[48] Later it was shown that information might be obtained as to the vascular status of the extremities by cutting down the rate of heat loss from the body by wrapping the subject in hot blankets.[18, 49]

Information just as definite may now be secured by the use of the relatively simple procedure of applying heat either locally or to a part of the body removed from that under examination.

Ipsen[50] says that a difference of over 1 degree C. in the average daily temperature of the two feet (average of five measurements at three hour intervals) points to an abnormal circulation in one extremity. This symptom appears to be constant in phlebitis while not specific, and often leads to its diagnosis at an early stage. His present procedure is to take foot temperatures when a patient complains postoperatively of pain in one extremity. When the temperature symptom has not appeared in a short time (eighteen hours, possibly more in pelvic phlebitis) phlebitis has not been seen.

Skin Temperature as a Diagnostic in Conditions Other than Peripheral Vascular Diseases

The temperature of the skin may be used as an aid in the diagnosis of conditions other than those of peripheral vascular diseases.

The temperature of the skin surface has been measured for its diagnostic value in several neurologic conditions. It has been found possible to differentiate fever of central origin from other types by noting the difference in the skin surface temperature. In the more usual febrile states, such as septicemia and typhoid fever, the surface temperature of the skin becomes elevated to within 2 degrees C. or less than the internal temperature, whereas in central fever (due to brain tumor, internal hydrocephalus, encephalography and the like) the skin is comparatively cooler — even as low as 5 degrees C. less than the internal temperature.[51]

In hemiplegia the skin temperature is said to be lower on the paretic than on the unaffected side.[52, 53, 54] In sciatica the temperature of the skin of the involved extremity becomes diminished.[55]

There is a relationship between vascular supply and the psychic centers, as indicated by experiments in which the surface temperature of circumscribed skin areas was raised by suggestion in hypnosis.[56]

We have noted that while high skin surface temperatures are found in the region of joints during the presence of an acute arthritis, low surface temperatures occur over the joints in chronic arthritis. Others have made similar observations.[54, 57, 58] This explains why arthritic individuals often complain of numbness and cold hands and feet. In arthritic patients who have a low surface temperature, a slow and sometimes interrupted blood flow is observed in the capillaries. However, the presence or degree of severity of the arthritis is not constantly reflected in the capillary or temperature changes.[59] It has also been noted that the skin surface temperature over tuberculous joints is elevated.[5]

Information concerning the temperature of the skin surface may prove of value to the dermatologist. Thus observations of the surface temperature in areas of alopecia areata show no essential difference between these areas and the adjoining normal skin, indicating that this condition is not due to restriction of local blood supply.[60] Changes in skin surface temperature occurring in leprosy have been described.[61]

A localized draft on the head causes a fall in the surface temperature of the face and in the temperature of the nasal mucosa. Chilling of the feet produces a reflex rise in the temperature of the nasal mucosa and a less marked rise in the temperature of the oral mucosa.[62]

Skin Surface Temperature Changes for Therapeutic Evaluation of Drugs and Physical Measures

The local skin surface temperature is affected by the rate of capillary circulation.[63, 64] If the circulation slows up, the local temperature falls. This permits

us to evaluate the effects of foods, drugs and other measures upon the peripheral circulation simply by observing the changes in skin surface temperature. The thermocouple becomes a valuable instrument by means of which we may gauge the influence of various measures upon the peripheral circulation. By observing changes in the skin surface temperature of the body, particularly of that part which goes through the widest range of change — the toe — we have, for example, learned that acetylsalicylic acid causes definite vasodilatation (fig. 16).

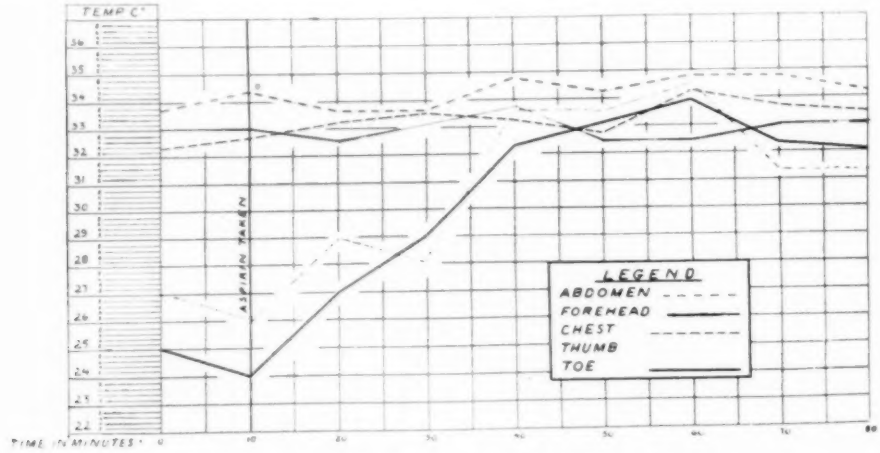

Fig. 16. — Reaction to acetyl salicylic acid (10 grains); normal female, 26 years.

This may explain the value of this drug and of other similar drugs acting as antipyretics.[65] It may also explain the subjective relief which this drug appears to afford sufferers from chronic arthritis (in which condition endoarterial changes in the blood vessels supplying the joint have been described), and those suffering from peripheral vascular disease.

The skin surface temperature reaction to tobacco has been described. In many individuals smoking causes peripheral vasoconstriction as evidenced by a lowering of the surface temperature[66, 67] (fig. 17).

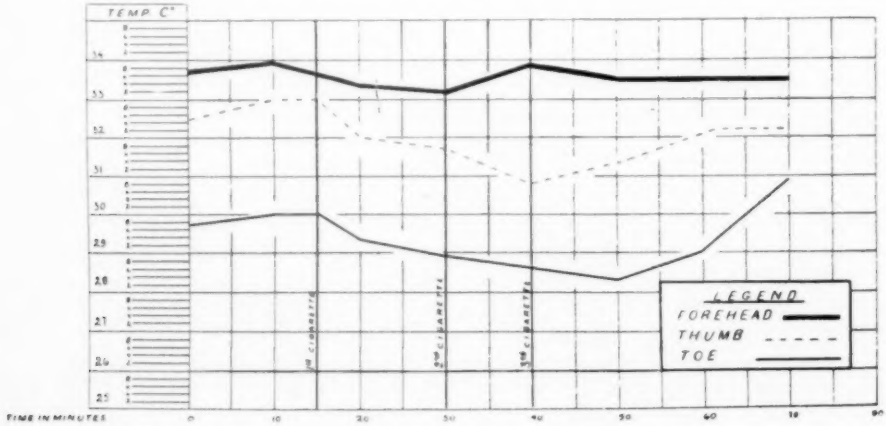

Fig. 17. — Reaction to tobacco, three cigarettes.

The ingestion of hot water causes an elevation of toe temperature. The response is probably like that which occurs when enough heat is applied to any part of the body — to the forearm, to the chest, and other parts — so that the

temperature level of the body is threatened. The application of heat by means of the hot water bag, hot compress, mud baths, and the like, causes an elevation of the local skin temperature and, if sufficient heating energy is applied, of the temperature of remote parts of the body surface.[5, 68] Observation of the skin surface temperature permits the evaluation of the efficiency of various physical therapeutic measures. Thus studies have been made of the influnce of salt water baths,[69] of mud baths and mud packs,[70] of radiant energy,[71, 72, 73] of diathermy,[74, 75] (fig. 18) of short wave currents,[76] of hot and cold baths,[77] of CO_2 baths[5, 78] of "moor" baths,[78] and of unipolarly charged air.[79]

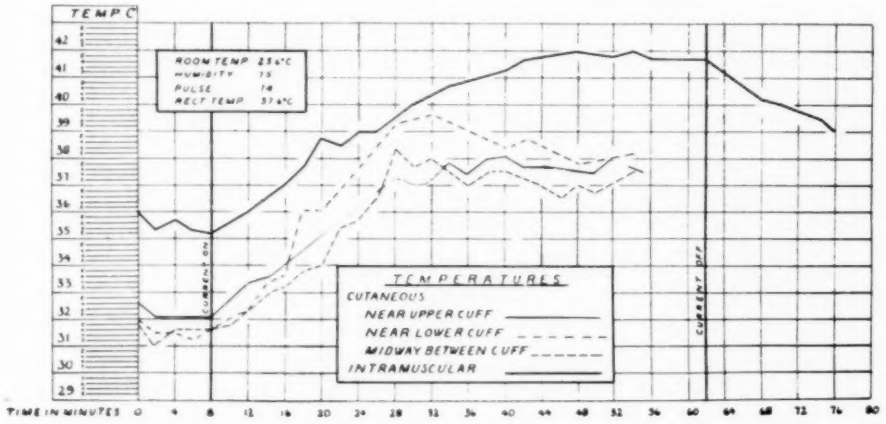

Fig. 18. — Effect of diathermy cuff technique applied to leg; normal male, 40 years.

Alcohol causes a peripheral vasodilatation as evidenced by the rise in skin surface temperature of the toe[80, 81] (fig. 19). We observed that the rate of rise is faster after the drinking of whiskey than after wine.

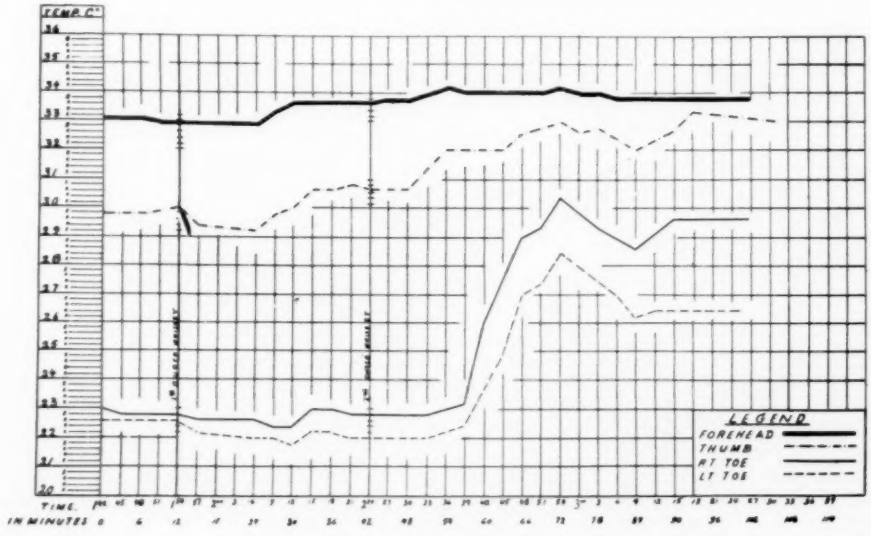

Fig. 19. — Effect of whiskey (two ounces); normal female, 30 years.

The ingestion of coffee as a rule causes a definite lowering of the skin surface temperature of the toe (fig. 20). In our experiments, the coffee was administered at a temperature of about 37.5 degrees C. Decaffeinated coffee does

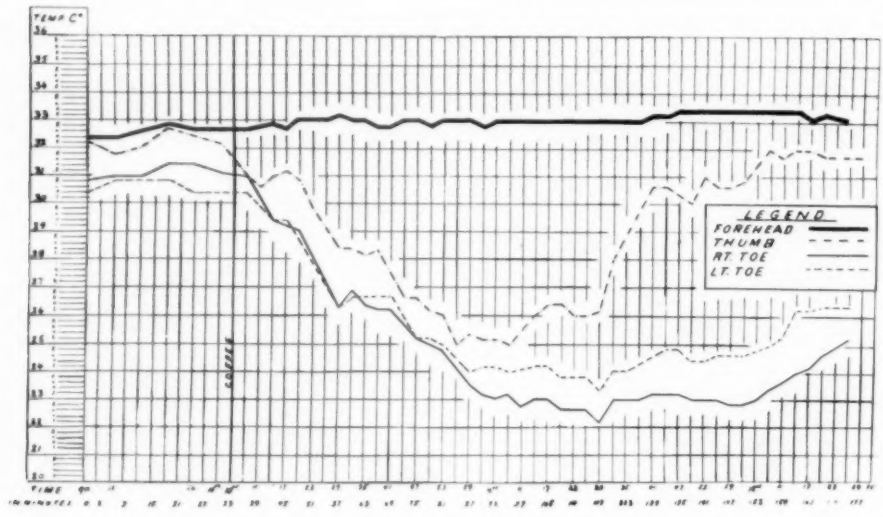

Fig. 20. — Effect of coffee (two cups); normal subject, male, age 20 years.

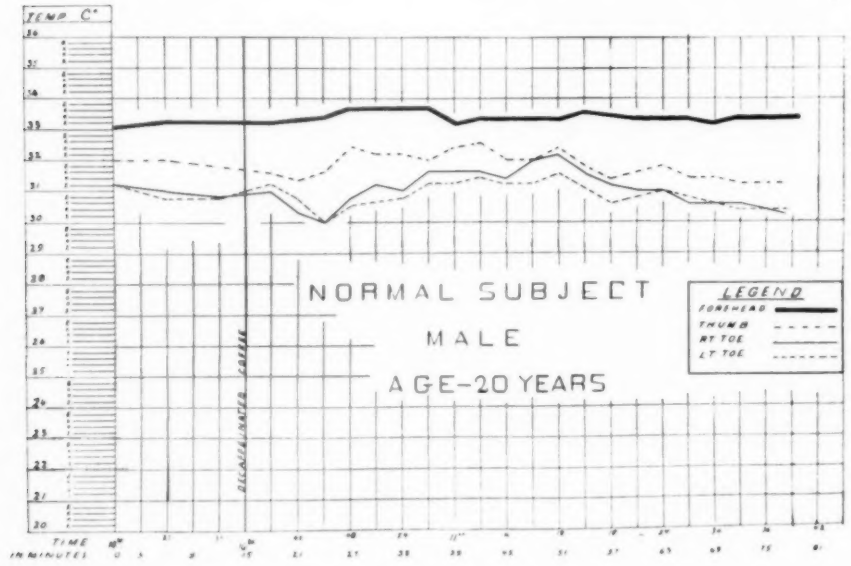

Fig. 21. — Effect of decaffeinated coffee (two cups).

not produce this change (fig. 21). Caffein, if administered hypodermically in the form of caffein sodium benzoate (fig. 22), or by mouth as caffein citrate, causes a decided lowering of the skin surface temperature of the toe.

Thyroid extract increases the temperature of the skin surface of the extremities. Amyl nitrate does likewise, while pilocarpin decreases the temperature of the skin of the extremities.[6] The latter drug acts by stimulating the sweat glands, causing cooling by evaporation of the sweat without any preceding increase of the skin surface temperature.[5]

The application of tincture of iodin and of mustard oil causes an initial lowering of the skin surface temperature, at the site of application, followed by an increase of 1-3 degrees C., lasting for from five to ten hours. If we produce active hyperemia by rubbing, the skin surface temperature rises according to the strength of the stimulus, to the irritability of the individual, and to the

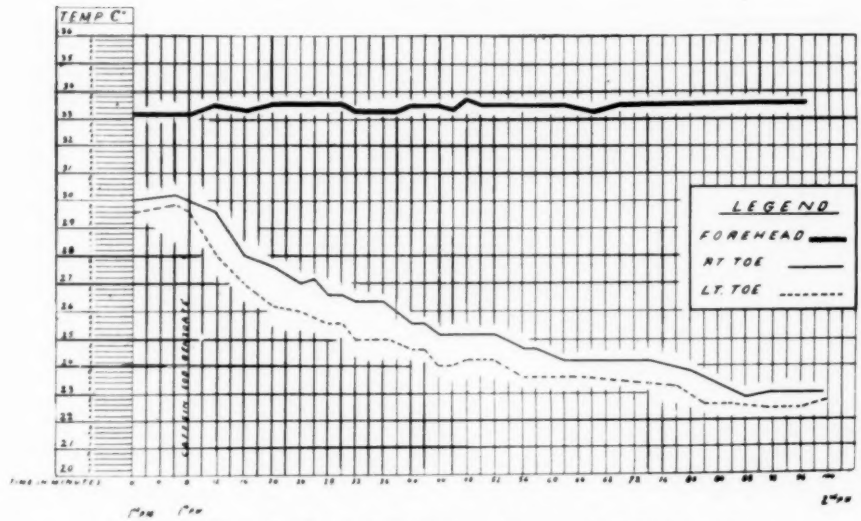

Fig. 22. — Effect of caffein sodium benzoate; intramuscular injection, grains.

initial skin temperature. The rise amounts to from 1-3 degrees C. and is usually limited to the site of irritation. The reaction is rather brief, reaches its height in about five minutes, and gradually subsides in the course of another ten minutes.[5] These experiments substantiate the very old impression that a cold skin can be warmed by vigorous rubbing and that unpleasant sensations of cold can be counteracted by this means.

It may be of interest to evaluate the effect of other physical procedures and of the ingestion of various food and drug substances upon the peripheral circulation. While this objective evidence may not be the sole guide for the application of various therapeutic measures, it does give us a definite standard by which these measures may be judged.

Effect of Environmental Temperature, Humidity, and Air Motion

Ideally, observations of skin surface temperatures should be made in a temperature-controlled room, inasmuch as the factors of room temperature, humidity, and rate of air motion influence the temperature of the skin.

Systematic investigations on the relationship between room and skin temperature have been made.[82] A positive correlation has been described between skin temperature and air temperature, the skin temperature increasing at the rate of 0.27 degrees C. per degree C. of room temperature, with a corresponding shift of 3 per cent of the total heat from radiation and convection to the latent heat of evaporation.[83] At the higher room temperatures, the physiologic action of sweating cools the skin.[84] In a temperature of 40 degrees C. or over, cooling of the skin is due solely to perspiration. In air temperatures as high as 70 degrees C. the skin surface temperature maintains a level of about 37 degrees C. for a long period of time provided the air is dry enough to permit evaporation of water on the skin surface.[6]

The temperature of the skin as measured over the forehead and over the carotid may be used as an index to the degree of comfort of the individual. One might place the extremes of the comfort zone for the skin temperature of the forehead or carotid as lying between 31.5 and 35.5 degrees C., a range of 4 degrees C. with the optimum of 33.5 degrees C.[85]

Within the range of its usual fluctuations, the degree of moisture in the air seems to have little influence on the skin surface temperature. It is of greater importance when the environmental temperature is high. Whereas with a normal

degree of moisture, even though the room temperature be above the 35.5 degrees C. the skin temperature usually does not exceed 36 degrees C. due to the evaporation of sweat. In an atmosphere saturated with steam at the same temperature, overheating of the body occurs because the sweat is not able to evaporate.[5] A positive correlation exists between skin temperature and room humidity during the closed window season, which is wholly ascribable to evaporation from the respiratory tract, and which is so small as to be readily reversed by the slight effect of freer ventilation in the open window season.[82]

Other things being equal, heat loss is proportional to the square root of the velocity of air motion. It has been shown that weak air currents (where the speed of air motion is less than 0.5 m. per second) influence the temperature of the skin and heat loss from it.[86] The rate of air motion can be measured by means of a kata-thermometer.[87] An attempt has been made to evaluate the influence of the environmental factors by means of a "frigorimeter."[88]

Instruments for Measuring Skin Surface Temperature

For measuring the temperature of the surface of the skin, the mercury thermometer is a relatively unsatisfactory instrument. However, lacking other instruments for the purpose, it may be used fitted with a wedge of cork to prevent loss of heat to the air,[89] or in a special shape with the lower portion flattened and bent at right angles to the stem. The mercury thermometer is objectionable because of its slowness in recording and because covering the surface distorts the temperature of the region.

The development of the thermocouple has simplified the study of skin surface temperatures. This instrument, which depends upon the production of a minute electric current when the joined ends of two dissimilar metals are heated (an effect described in 1822 by Seebeck)[90] may not be an absolutely accurate one. However, since in a good instrument the degree of inaccuracy is small, and since for most occasions the comparative values of a number of determinations are the important consideration, the thermocouple is a practical instrument for its purpose. Thermocouples for the measurement of skin surface temperatures have been described by several workers.[91, 92, 93] For routine purposes, we have found one constructed with an automatically compensated cold junction to be the most satisfactory.[94] Resistance thermometers for the same purpose have been described.[28, 95, 96, 97]

Cobet and Bramigk[98] measured the radiation of heat from a definite area of skin surface and made comparisons with the temperatures determined directly by means of a thermocouple. They concluded that the readings obtained by means of the thermocouple were too low. They attributed this to the influence of the cooling effect of the air of the room on the thermocouple wires so that the recorded temperatures are intermediate between that of the skin and that of the air. However, other investigators[99] have shown that the error from this source is very small, since in still room air at about 21.5 degrees C. the temperature of the air within 1 mm. of the surface is less than 1 degree C. below that of the skin, and within 0.5 mm. less than 0.2 degree C. below. It has been pointed out that a more frequent source of error encountered in the use of thermocouples is due to the conduction of heat away from the site of measurement by the wire of the thermal junction itself. It is stated that this error can be reduced, however, to less than 0.5 degree C. by allowing sufficient length of wire next to the junction to come into contact with the skin or by using a wire of small caliber and of low conductivity.[26] The whole error involved in making measurements by means of thermocouples is probably not large ($\pm$0.5 degree C.). Hardy[100] states that while the thermocouple is in general a rugged and simple instrument, it cannot be relied upon where relative accuracy greater than $\pm$0.5 degree C. or an absolute accuracy greater than $\pm$1.0 degree C. is required.

Inaccuracies may be due not only to the physical limitations of the instrument and the influence of the surrounding air, but also to the manner in which the instrument is applied, the firmness of its contact, the moisture of the skin, and the like. For these reasons, Hardy prefers to use a device which measures the radiation of heat from the skin. He has described an instrument which is relatively small and portable, and which he states is accurate to ±0.1 degree C. and ±0.1 small calory per second per square meter of radiation in absolute as well as relative value. Other authors[101] consider that the most accurate instrument for measuring the temperature of the skin surface is a radiation thermopile. These instruments, however, may not be as practical for everyday use as the thermocouple.

The loss of heat by radiation from the skin may be measured by the Stefan-Boltzmann law.[102] Tests of the emission curve of the human skin show that it radiates like a black body irrespective of its visible color; that the energy distribution in the spectrum is similar to that of an artificial black radiator, and that the presence of water vapor and CO_2 in the layers of air next to the skin does not appreciably affect the radiation from the surface.[103]

With the exception of the studies made in recent years, but few investigations have been conducted during the century that has elapsed since the development of an instrument suitable for the measuring of skin surface temperatures. It may well be that the relatively simple and accurate measuring instruments now available may help to usher in a period of intensive research, which should be fruitful in clarifying the diagnosis and the treatment of peripheral vascular as well as many other diseases.

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BIOLOGY OF ULTRASHORT WAVES *

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Many of the problems pertaining to the characteristics of ultrashort waves are intricate and difficult, for which reason it is gratifying that their study has been undertaken by a small committee working in close and critical cooperation. The discovery of the biologic properties of the high frequency current about 45 years ago by d'Arsonval has been followed in the last few years by research in the direction of therapy rather than pure science. It is therefore particularly encouraging that distinguished investigators in England have founded the *Duchenne Society* for the purpose of determining the fundamentals of ultrashort waves. I deem it a great privilege and honor to have been invited by this society to cooperate in its endeavors. I have accepted the invitation partly because I have devoted more than 35 years to electropathologic studies and partly because for the past six years I have experimented with a view of determining the biologic characteristics of ultrashort waves. I presented the fruits of my labors before the French Academy of Sciences (1930) and published later several articles, to which I must refer, the purpose of this paper being to submit a few more recent observations.

As I had already learned from electropathology that the heating effect of electricity could almost completely obscure its primary action, I chose in my experiments methods and conditions, which almost totally excluded the heating effect. Accordingly I have carried out almost all my biologic experiments with a very weak field, viz., one watt and nearly always with a 3 meter wave. I found through thermoelectrical measurements that the inner temperature of eggs and of chrysalises, which had been under the action of such a field for many days, was only 1 to 2 degrees higher than that of the control objects or of the surrounding air. A phenomenon which also speaks for the absence of heating effect was the following: If one puts newly born mice into such a weak field, the effect is instantaneous, the mice are as if paralyzed and show no sign of motion, but as soon as they are taken out of the field they move again quite naturally. It is also interesting to know that the same effect can be produced acoustically on new born mice by handclapping.

The same phenomenon is observed on protozoa in a drop of water. The cilia both of paramoecium and vorticella are immediately arrested and in addition the paramoecium remains quite still. The one difference here is that the paramoecium cells are not only arrested but within a few seconds deformed and destroyed. Whether it is due to the delicate structure of protozoa that the weak field of 1 watt has a speedy destructive influence, has yet to be settled. The same weak field had biologically a favorable influence on the development of parrots' eggs and chrysalises, which to a certain extent proved biopositive. The favorable influence was somewhat different: In the case of the chrysalises the development of butterflies took place 3 to 4 weeks earlier than in the case of the controls. On the other hand the incubation period (18 to 21 days) in the case of the eggs was not shortened, but the process of maturing took place at an inner temperature of 28 to 29 degrees C., whereas the temperature necessary in an ordinary incubator is 38 degrees C. This difference in temperature may possibly be explained on the assumption that the oscillations work either as a relay or a catalysator.

* Read before the Duchenne Society, London, England, May 11, 1936.

Some experiments I made in a very strong field (1000 watts) in order to study the *heat action*, showed that this also is very difficult to understand. If a hen's egg is left in such a field for 5 minutes, the effect is that its whole outer surface is suddenly covered with tiny water drops, so that one could say, the egg sweats. If we pierce the egg with a thermoelectric needle, we find that the coagulated albumen has a temperature of 80 degrees C., whereas the coagulated yellow has only 60 degrees C.

If a fresh pig's eye lens is laid in the field without any holder and exposed for 5 minutes, one sees no change; on the other hand, if such a lens is placed in a test tube and exposed to the field for 20 to 30 seconds the lens becomes opaque and white, measurement with the thermoelectric needle registering 65 degrees C.

As a further contribution to the subject of the heating effect I should like to mention the following experiment. It is known that the resonance of a field is liable to be disturbed by the mere movement of the fingers in the neighborhood of the secondary current. It is striking to see that the lighting or extinguishing of a glow lamp is affected according to the positions of the fingers in contact with the lamp. It has been demonstrated that the light (sc. heat) of a glow lamp is extinguished if the position of the lamp is altered by 90 degrees. The effect is the same if I touch the lighted lamp with one finger. If I hold the lamp between two fingers, the effect is dependent on the relative position of the two fingers to each other: If the fingers are directly opposite each other, the lamp does not light, if the one finger is higher than the other, the lamp burns.

In conclusion I should like to demonstrate an experiment, which shows a phenomenon concerning a relation between the high frequency current and the human body. A cylindrical Geissler tube connected with a Tesla transformer shows throughout its whole length a beam of light. If I place my finger close to the glass tube but without touching it, the beam directly opposite my finger remains no longer in a straight line but in this part curves in a direction away from the finger, the breath of the curve corresponding approximately to the breadth of the finger tip. If I vary the experiment and pass the Geissler tube over the body of a man e.g. over the chest, it becomes possible to determine the borderline between the lung and the liver. This borderline is marked by the changing of the color of the beam and by alteration in the sound of the oscillations.

An instructive experiment can be carried out in the dark. If the Geissler tube is passed over the outer surface of a vessel partly filled with water, the level height of the water can be determined by the same phenomenon as in the last mentioned experiment.

All these experiments have only confirmed what we already knew from our experience in electropathology and electrophysiography, namely that there are not only heating but other specific effects of electric energy and that in addition to the electrochemical effect the *electromechanical factor* plays a dominant rôle. That heat is an accompanying characteristic of electricity, has already been proved in the very first experiments of physicists, but our task in biologic research is to place the new ultrashort wave therapy on a scientific basis.

Editorial Note: Professor Jellinek has suggested that this publication be considered as a preliminary report as he intends to present a more extensive study on the subject at a later late.

CERVICITIS *

Five Years Experience With Diathermy

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For the past five years various surgical diathermy procedures have been applied to ambulatory cases of chronic cervicitis in the outpatient department of the Washington University Medical School. These cases have been followed by its Social Service at three months for the first year after treatment, and every four to six months thereafter. In this manner, it has been determined how lasting a result has been obtained by the various methods employed.

The patients are selected from the general gynecologic clinic and referred to the cervicitis clinic. Here the chronicity of the cervix is determined by the Schiller iodine stain and colposcopy and an attempt is made to rule out definite malignancy. Biopsies for study are taken, and the cervix is treated in the manner to be described.

Cervicitis is a condition of structural change in the cervix. It is produced by the gonococcus or by non-specific pyogenic organisms which have gained a foothold because of trauma to the cervix. The erosion of the cervix is columnar epithelium extension replacing the squamous epithelium. The healed erosion of cervicitis is the squamous epithelium growing back over the columnar extension. This causes the racemose gland to become permanently blocked with a resulting hypertrophy of the entire cervix, and producing the picture of chronic cystic cervicitis. Whatever erosion exists at this stage depends on the completion of regrowth of squamous epithelium. If the columnar epithelium is piled up so that the squamous epithelium cannot replace it, a papillary erosion with ectropion formation exists.

The purpose of sketching these lesions is to emphasize that the treatment for such a condition must be one of removal of such a structural change. To patch it up, so to speak, means inviting trouble in later years. If the squamous epithelium has lost out in the erosion struggle and grown abnormally, the entire cystic diseased gland bearing area must be destroyed and removed so that a single layer of squamous epithelium can line the newly constructed cervix and its canal.

The Sturmdorff operation is designed for and very effectively accomplishes this end. It became the problem to apply this principle to the ambulatory patient. By using a small flat curved knife blade and sufficient cutting current to give this knife mobility within the cervical tissue, it became possible to proceed as one would do the Sturmdorff operation, namely, to gouge out and coagulate *en masse* a conical area of diseased cervical tissue. This was done by the probing method in order that a varying depth of removal of diseased tissue could be accomplished by the sense of touch.

Some three years ago we used the Hyams cutting loop[1] which is the popular electrode for approach to this problem. At that time we limited its use to cervicitis in nulliparous and to cases where the diseased process seemed equidistant from the cervical canal. At the present time a few cases have been cut out with larger loops after the manner of Dannreuther and Hyams. However, these have all been hospital cases and as yet this has not been widely used in the cervicitis clinic.

* From the Department of Obstetrics and Gynecology, Washington University School of Medicine, Barnes Hospital, and St. Louis Maternity Hospital.

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 9, 1935.

About one-third of all patients with cervicitis have the chronic cystic type. About three-fourths of those seen in the clinic are in an advanced stage. In these cases, especially, it has been felt that the knife probing depth removal has given more lasting results than the wire loop conization that cuts through the cystic area, and improves the condition by drainage rather than actually removing all of the cystic area by destruction. Bits of the squamous epithelium are often seen at the base of glandular crypts. Some of the cases which were cut out with a Hyams loop later developed further cystic change and required a probing depth removal by the coagulation method in order to destroy all the gland bearing tissue. This would seem to force one into the opinion that the best conservative procedure is radical removal of the diseased tissue. This technic is indicated only while the cervicitis is in a stage of regression and chronicity. There must be no acute or subacute parametritis. The patient must have just finished a normal menstruation. This enables the cervix to pass through the trauma of surgical diathermy, with the resulting slough producing a minimum of systemic reaction. The active sloughing stage is over within ten to fourteen days, and a short granulation period follows. This granulating stage of healing is shorter than that which follows the conization method.

It appears that there is less tendency to immediate hemorrhage with the knife coagulation method as compared with conization, as no packing is ever used after the former procedure. For this reason we have adhered to the knife coagulating method for ambulatory cases, and favor a large wire loop removal for hospital cases, for whom the Sturmdorff operation has not been elected.

In the clinic, since all doubtful cases as to malignancy are stained with the Schiller iodine Lugol solution and studied with the colposcope, biopsies are taken from the poorly stained areas with a scalpel or a rongeur punch. The experience has been that some doubtful cases of malignancy are obscured when the biopsies are taken with a high frequency wire loop, as the basement layer of epithelium and gland are sometimes destroyed by the heat.

At present the impression is that by use of Lugol's stain and spot biopsies of the poorly stained areas very early malignancies can be picked up, and in such cases when we have gone back to the cervix and removed all the remaining tissue no further evidence of malignancy has been found.

Since the coagulated or coned tissue is not generally used for biopsy material, a few cases have been coagulated with the probing knife and the coagulum then cut out and removed by the Hyams wire loop to lessen the slough. This is a reversal of the procedure of first cutting a large cone and then coagulating the bleeders. The advantage of the former lies in the varying depth of glandular destruction necessary to reach all the diseased tissue in some cases. It does not leave as much of a slough as coagulation alone, and insures a shorter granulation stage. The volume of the cervix is reduced by the destruction of the gland bearing area, so that there is much less tissue to be removed by the cutting wire loop.

No anesthetic is used in ambulatory cases. Sodium amytal or other suitable barbiturate with hyoscin, or small doses of morphine and hyoscin are used on cases that are hospitalized for twenty-four hours or longer. Every effort is made to have the cervix and vagina cleaned up before the surgical diathermy is used.

Douches after the procedure are of little or no value except to reduce the odor. For this perfumed vaginal suppositories or vaginal jellies can be used.

Further consideration of this five-year study will be taken up under the following topics:

A. Primary hemorrhage.
B. Secondary hemorrhage.
C. Postoperative stenosis of the cervix.

D. Postoperative pelvic infection.
E. Pregnancy following surgical diathermy.
F. Carcinoma at the time of surgical diathermy of the cervix.

Primary Hemorrhage

Only one patient in the series required packing after surgical diathermy of the cervix. This was a woman in whom previous biopsies had shown questionable malignancy, and the remaining portion of the cervix was removed with a cold knife so that no confusion in the picture of early malignancy could be attributed to the heat effect on the epithelium. After this tissue was removed, the cervical stump was coagulated in mass, but the hemorrhage was not satisfactorily controlled and a large vaginal pack was used. When we use the wire loop to cut the cervix, we place a strip of gauze in the cervical canal as a precautionary measure, tying this strip of gauze to a string of an ordinary vaginal tampon so that when the patient removes the tampon herself the gauze would come out with it. Few of the cases that were coagulated first and then had the coagulum cut away with the wire loop were treated in this manner.

When mass coagulation technic with the probing knife blade is used, there is almost never any bleeding. The coagulated conical area of the cervix appears as a soft, white, putty-like plug and there is little or no oozing from the cervical canal. For this reason, we have felt that we were safe in permitting a patient whose cervix has been extensively destroyed by this method to get off the table and go home, feeling that there is practically no danger of initial hemorrhage. I have not enjoyed such a feeling of security when the wire loop conization method has been used in ambulatory patients.

Secondary Hemorrhage

In our series of cases we had two patients who had secondary hemorrhage severe enough to require blood tranfusion, and approximately ten cases that required packing. Four of these cases required a second packing of the vagina to control bleeding. Undoubtedly, the cause of these secondary hemorrhages is due to incomplete separation of the plug or an infection that erodes a blood vessel which otherwise would be sealed off. However, we must remember that all of these cases with severe secondary hemorrhage had the cervix removed practically completely by mass coagulation. One of these cases had, a year later, a complete hysterectomy for uterine lesions. At this time, it was clearly noted how completely all cervical tissue had been removed, the result being continuity of the lower uterine segment and vaginal vault.

Structurally, the cervix carries very large blood vessels and any subsequent erosion of these vessels can and does lead to dangerous hemorrhage. Great care must be exercised that surgical diathermy of the cervix is performed far enough in advance of menstruation, so that the entire slough will be out before the menstrual flow begins. Again the chronicity of the cervix is an important factor, as subacute or acute cervicitis will cause erosion of sealed blood vessels with subsequent hemorrhage. It has been considered that if the patient does not bleed as much as at a normal menstruation at the time of separation of the slough, there is nothing to be alarmed about that much bloody discharge during the sloughing stage. This degree of bleeding is quite common and probably is seen in 50 or 60 per cent of all cases. These patients are told to be off their feet as much as possible for the first week or ten days. Intercourse and douching are forbidden for that same period, although we have reason to believe that these instructions are not followed. If secondary hemorrhage is going to occur, it will usually put in its appearance from the fifth to the tenth postoperative day.

Postoperative Stenosis of the Cervix

I[2] reported some 44 odd cases without incidence of stenosis. These cases had the new cervical canal tested with a probe and uterine dressing forceps up to and just through the level of the internal os. Having thus been assured of the absence of stenosis, this exploration was not done on all subsequent cases, and a rather high incidence of a membrane-like formation resulting in cervical stenosis followed. It then became apparent that the routine sounding had kept the cervix from becoming stenosed, and it is now our practice to dilate the healed cervical canal carefully at about six weeks to two months after coagulation. This is done by the passing of a wire probe and then a uterine dressing forceps, gently spreading the new healed walls of the cervical canal. Unless this is done, a large number of stenosed cervices will result. Pyometra, however, was very rare even in cases that required dilatation and curettage because of a stenosis that was not corrected in the early stage, due to the patient's failure to return.

In the article referred to, I attempted to point out the difference in healing between cauterized, that is, carbonized tissue, and tissue which has been coagulated without carbonization, the latter healing with little or no contracting scar tissue.

There have been some 25 cases that have required dilatation of the cervix because of stenosis, only 4 of these 25 having had the proper technic of dilatation at a six weeks or two months period following the initial surgical diathermy of the cervix. Two patients were thought to be pregnant because of missed menstruation and softening and enlargement of the uterus.

In elderly women past the menopause it seems impossible to keep the healed cervix open, yet to my knowledge none of these cases have developd a pyometra. The appearance of the cervix in these cases is like one that has received 1500 to 2000 mg. hours of radiation of the uterus.

Postoperative Pelvic Infection

Although several patients reported mild malaise and a few ran low grade temperatures following surgical diathermy to the cervix, only two cases had acute pelvic cellulitis requiring hospitalization, and neither of these cases came to abscess formation. One other patient, who did not follow instructions to remove tampons, entered the hospital with fever and a very foul vaginal discharge. Upon removing the tampon, the acute parametritis immediately subsided. One patient entered Barnes Hospital January 25, and remained until February 11, 1932. She had an acute pelvic cellulitis which was believed might result in an abscess formation which, however, did not take place. On February 24 examination in the clinic showed the cervix to be healed and in good condition, without masses or induration in the adnexa.

One other case that ran a temperature following coagulation was known to have had an acute gonococcal salpingitis about four months before. This illustrates the absolute necessity of instituting this cervical procedure in only definitely known chronic cases.

In going over the records of Barnes Hospital for the past five years, 57 cases of pelvic abscess requiring cul-de-sac drainage or drainage by laparotomy were studied. The great majority of these cases gave a history of repeated chronic pelvic inflammatory conditions with many acute exacerbations. None of these cases had acute cervical conditions as an etiologic factor at the time of the abscess formation, unless the gonococcus was found in the cervix and in the pus obtained from the cul-de-sac abscess.

I believe that every precaution should be taken to guard against pelvic infection secondary to cervical diathermy, but I do not believe that our records show it to be a common complication.

Case Reports of Pregnancy Following Surgical Diathermy

The following cases illustrate that coagulation of the cervix does not interfere with pregnancy and parturition:

CASE 1. — G. W. Confined at City Hospital, a gravida 8, age 34, had coagulation of the cervix November 30, 1932, with a good result. Had a normal pregnancy and parturition. Delivered January 11, 1935, after two hours of normal labor. No cervical laceration or subsequent erosion.

CASE 2. — L. B. Confined at St. Louis Maternity Hospital, a gravida 3, age 28, was referred to the cervicitis clinic with a deeply lacerated cervic which was enlarged and contained many Nabothian cysts. Extensive coagulation February 14, 1934. Normal pregnancy followed. She was delivered October 23, 1934, after 10-hour labor, of a 3430 gm. child. Slow dilatation of the internal os which was finally manually dilated, with immediate precipitation of the child. Repair of cervical laceration, terminating in a small radial laceration of the cervix.

CASE 3. — D. McC. Confined at St. Louis Maternity Hospital, a gravida 3, age 27, had a normal pregnancy except for pyelitis at five months gestation. She had had a coagulation of the cervix in 1932, and was confined and delivered of a 4100 gm. child after a 9-hour labor in 1934. No cervical dystocia, laceration or subsequent erosion.

CASE 4. — H. W. Confined at St. Louis Maternity Hospital, a gravida 4, age 37 years, had a coagulation of the cervix April 5, 1931. Subsequent normal pregnancy and confinement, delivered after a 9-hour labor of a 3320 gm. child in March, 1932. No cervical laceration, no subsequent erosion.

CASE 5. — L. V. Confined at St. Louis Maternity Hospital, age 27, in 1931 had an extensive coagulation of the cervix. In 1932 she became a gravida 5, para 3, delivered of a stillborn child, seven months gestation, after a 3-hour labor. Became pregnant again in 1933, normal pregnancy, delivered of a 2240 gm. child after 12-hour labor, no cervical dystocia, no cervical laceration or subsequent erosion.

CASE 6. — M. J. Confined at St. Louis Maternity Hospital, age 30, had an extensive coagulation of the cervix in March, 1932, became subsequently pregnant, gravida 2, and was delivered January, 1933, of a 4100 gm. child. Uncomplicated delivery without cervical dystocia, no cervical laceration or subsequent erosion.

CASE 7. — F. R. Confined at home by the outpatient service, had a coagulation April, 1932, and was delivered of a 4000 gm. child in January, 1933. Cervix slightly lacerated, healed later with no erosion.

CASE 8. — H. H. Confined at City Hospital, a gravida 8, age 39 years, had a coagulation in 1931, diagnosed pregnant August, 1933, contracted influenza, complicated by lobar pneumonia during the eighth month of her pregnancy, January, 1934. Died in labor as a result of the pneumonia, cervix dilated three fingers.

CASE 9. — E. H. St. Louis Maternity Hospital, gravida 3, para none, age 27 years, extensive coagulation of the cervix September, 1932. Four months later, had a curettage, perineorrhaphy and a lapartomy, partial ressection of the left ovary and shortening of the round ligaments. Pregnant in 1934, had an incomplete abortion and was curetted. Cervix not thought to be a complicating factor.

CASE 10. — V. O. Confined at Missouri Baptist Hospital, age 36, had a coagulation of the cervix in 1931 with subsequent stenosis which was corrected by the use of a stem pessary. Became pregnant in 1932, was delivered of a 4500 gm. child without cervical dystocia after 10-hour labor. In 1933, she had a Manchester operation for uterine prolapse. At this time, a cervical amputation was done. There was no laceration of the cervix, no erosion, miscroscopic section showed that the cervix has healed well, was completely lined by a single layer of squamous epithelium.

There were eight other known cases that subsequently became pregnant following surgical diathermy of the cervix, but these cases have been lost sight of by the social service. When one considers the general age incidence of the series of all cases on which surgical diathermy was used, and the fact that practically all of these cases had borne children, and many at the time of treatment had chronic pelvic inflammatory disease, it is not surprising that only eighteen cases out of our series have become pregnant. In addition to the above, some cases were referred to the contraceptive clinic after the cervical lesions were cleared up.

We may conclude from our observations, that radical surgical diathermy of the cervix is not a handicap to subsequent pregnancy and delivery.

Surgical Diathermy in Early Malignancy of Cervix

There have been three young women, aged 27, 30 and 32, who had miscroscopic examination reports of early carcinoma of the cervix. Two of these cases were given radium, and the other is under observation at the present time. There is a fourth case of doubted carcinoma of the cervix, it being so early that a definite diagnosis can not be made. This case is also under observation. One of these cases is now in her fourth year, two are in their second year, and one in her first year. Histologically and clinically these patients are at the present time entirely free from carcinoma.

It is to be taken into consideration that no known case of carcinoma has been treated by mass coagulation as a first choice procedure, but that the routine biopsy has disclosed the early undiagnosed condition. However, a *Scandinavian Journal of Radiology* reported several hundred cases of early carcinoma of the cervix that have been treated by mass coagulation and subsequent x-ray with excellent results. I mention this purely to show that we do not feel that we have done our cases an injustice by handling them in the described manner, but I distinctly do not wish to create the impression that I am advocating coagulation of the cervix as a therapy for early carcinoma of the cervix. It is just the border line case of advanced cervicitis and questionable early malignancy that responds well to amputation of the cervix by mass coagulation. These cases have been among our radical complete removals where nothing but a small dimple is left in the vaginal vault.

The use of the Schiller iodine stain, together with the colposcope, has made possible a separation of cervicitis from early malignancy in the majority of cases, and the latter cases are handled entirely in the cancer clinic. But the more cases of advanced cervicitis one sees, the more one is impressed that the gradation from cervicitis to malignancy is difficult to make. This stresses the need of some method of treating cervicitis that can be applied to a large number economically.

Conclusions

1. For cases of chronic cervicitis where the entire gland bearing area of the cervix must be destroyed to a point of practical cervical amputation, mass coagulation by means of the knife method gives excellent results.
2. This procedure is first choice for ambulatory patients. It is probably second choice for hospitalized cases, where bed rest and observation render radical conization a safe method.
3. The troublesome vaginal discharge during the sloughing period is a serious complication.
4. In cases where a supravaginal hysterectomy has been performed and a serious cervicitis has subsequently resulted, mass coagulation has given results equivalent to a complete hysterectomy.
5. Some 350 cases of cervicitis have been treated by surgical diathermy in the past five years with:
   a. Primary hemorrhage incidence .03 per cent.
   b. Secondary hemorrhage incidence 3.4 per cent.
   c. Subsequent stenosis incidence 7.4 per cent.
   d. Postoperative pelvic infection, incidence of acute pelvic cellulitis .06 per cent. Morbidity incidence about 2.5 per cent.
   e. Pregnancy following cervical diathermy incidence 5 per cent.
6. Adequate treatment for cervicitis is some method that will completely and permanently remove the diseased gland bearing area of the cervix.
7. Of all cases treated 86.61 per cent had an uneventful postoperative

course and good result. Good end results were obtained in 94 per cent of all cases treated.

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* Thanks are herewith expressed to Dr. F. H. Ewerhardt for his assistance in making possible this study.

(*Discussion on page 523*)

FURTHER STUDIES OF ENDOCERVICITIS, CERVICITIS AND EROSIONS *

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Owing to its strategic location, anatomic construction and rich lymph and vascular supply, the uterus, the tubes, the ovaries and periuterine structure are easily attacked by microorganisms, moreover these organs are a prolific source of focal infections.

Much of this is clearly understood, but the important rôle played by the cervix, that of a focus of infection capable of disseminating microorganisms and their toxins to more distant structures, is not fully appreciated by the majority of practitioners. Few seem to realize that the uterine cervix is a potent factor in the etiology of pelvic adenitis, pain in the lower abdomen, bladder and menstrual troubles, general ill health, fatigue, headaches, cardio-vascular disturbances, backache and arthritis. All this in addition to the usually well recognized symptoms of cervical infection, such as leukorrhea, erratic bleeding, dyspareunia, tubovarian disease.

As a center of infection both local and general, the teeth and tonsils have been maligned to the last degree, and if eradicated or not found guilty the investigation for a focus of infection has been abandoned and the attention turned to less likely causes, ignoring or forgetting that the uterine cervix and the prostate are just as frequently at fault as the teeth and tonsils. Perhaps one reason for ignoring the cervix and prostate is their comparative inaccessibility. We know that an infected tonsil or tooth can and does cause severe pain *in situ*, cervical adenitis, myositis, fibrositis and neuritis besides constitutional ill health, cardiovascular disease and arthritis.

The anatomic makeup and location of the cervix lends itself readily to the acquisition, growth, maintenance and distribution of pathogenic bacteria with all their deleterious products. The mucous membrane of the cervix is thick and plicated. Its columnar epithelium is ciliated down to the external os where it changes to the squamous laminated epithelium that covers the vaginal portion of the cervix. Many racemose glands open into the

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 9, 1935.

furrows of the plications and these are liable to pathologic changes due to infection and cause them to assume a vesicular character known as Nabothian cysts. Thus we find in the cervical canal an area with corrugations and folds containing deep seated racemose glands with tortuous canals the mouths of which are easily obstructed, enveloped in tissues richly supplied with lymphatics and blood vessels. The cervical mucosa unlike that of the body of the uterus does not desquamate.

The anatomic relations of the cervix are important from a pathologic point of view. Above it is continuous with the corpus uteri, and the intermuscular lymph spaces of the two communicate. It lies embedded in the pelvic cellular tissue, which stretches out on each side at the bases of the broad ligaments. Posteriorly this cellular tissue is incorporated in the utero-sacral ligaments, which are attached to the sacrum on each side of the rectum, while anteriorly the utero-vesical connect the cervix with the bladder.

Focal Infection

The existence of foci of infection as a major cause in the production of local and constitutional disease is about as firmly fixed as anything in medicine. For a long time the close relation between the local activity of some malign influence and the distant manifestation of abnormal function has been recognized. Hippocrates speaks of a patient with joint trouble who improved greatly by freeing the mouth of much disease, and Benjamin Rush observed the benefit of the removal of abscessed teeth in joint disease. The more modern studies of Billings, Deland, Rosenow and Hayden are or should be familiar to all. While most of this work was based on observation on teeth, tonsils and sinuses, it is clearly evident that other anatomic structures may be potent factors. One or two of the outstanding sites are the uterine cervix and the prostate. The cervix and prostate should be as carefully examined as the teeth and tonsils in any condition thought to be caused by foci of infection.

The incidence of cervical infections is very large. In more than 6000 women successively examined, Fulkerson found a little more than a third to have cervical infections and that the condition existed in 78 per cent of all cases between the ages of 20 and 40. Other authorities differ but little in their estimates of its frequency, and it is safe to say that, alone or in combination with other lesions, it is present in 70 to 85 per cent of all patients examined.

It is my observation that most physicians do not pay sufficient attention to the cervix unless it is lacerated, eroded or bleeding. In such a case they proceed to cauterize the eroded area, produce cicatricial contraction, prevent drainage, and block the upper cervical infection. I have seen many cases where cauterization had worked little short of havoc. Just as reasonable to plug up an infected tooth canal or put good bridgework over a mass of pyorrhea. Long before the cervix has reached the stage just mentioned, it has perhaps produced the greatest damage. Such a cervix can be cicatrized down to a mere scar at the expense of the patient's well being. Here the least procedure is a rather extensive coring, or electrocoagulation, beginning high up toward the internal os. Perhaps a Sturmdorf if the woman is of child bearing age, or a vaginal hysterectomy after the menopause is to be preferred.

Over a considerable number of years I have consistently observed the menacing effect of infected cervices. Located in a smaller city it has not been difficult to keep track of my private patients. It will be conceded that a comparatively smaller number of patients closely observed, offers

better facilities for the determination of the course of disease and the outcome of treatment than the widely scattered thousands that constitute the material of a public clinic. Throughout the years, as our experience increased and ripened, we have modified and changed our methods.

Subsurgical Diathermy

Realizing the limitation and possible mutilating effect of radical surgery on the cervix extensive plastic amputations, and the like, were done less frequently. Beginning with the hot-point cautery we gradually shifted to electrocoagulation by high frequency current. By this means combined with the cutting current, we were enabled to eradicate with precision the gross lesions of an infected cervix. The last few years chief reliance has been placed on ionization and "subsurgical" diathermy, or medical diathermy of Cumberbatch and Robinson. Recourse is had to milder methods largely because we begin treatment in the earlier stages. Treatment is advised in all cases of endocervicitis, however mild in appearance, especially where in addition to the local symptom of vaginal discharges, we have backache, low abdominal tenderness, general ill health or arthritis. The technic practiced by Robinson and Cumberbatch is to place a lead belt around the patient's wrist and connect to one pole of a high frequency apparatus. To the other cord plugged into the medium or low voltage terminal is attached an electrode having a metal tip 3/16 inch thick, 3/4 inches long. This is inserted into the urethra and the current gently turned on until a sensation of warmth reaches that of pain. This was found to be at about 115 degrees F. The same electrode is then introduced into the cervix for 15 to 20 minutes.

It is apparent that this method of ascertaining the proper strength of the current is not mathematically accurate, but it serves as a starting point from which one must work out one's own technic. Electrical methods of treatment require a considerable outlay for apparatus and an infinite enthusiasm for taking pains, patience and above all an appreciation of meticulous technic.

We have found that where systemic symptoms of the cervical infection predominated, subsurgical diathermy gives the best results. The reason is not so much the attainment of bactericidal effects although a temperature of 105 degrees F. will kill gonococci, (but not pyogenic germs), as the creation of local hyperemia for the increase of leukocytosis, antibodies and drainage. The tendency has been to do away with corrosive bactericides and resort more to physiologic methods. This is particularly true of the cervix. The cervix is a very delicate organ and much multilation not only impairs or destroys its function but transforms the uterus into a pathologic appendage.

In my earlier experiences with surgical diathermy I, like many others, made the statement that cicatricial tissue from the high-frequency current did not readily tend to contract, and that the scar was not as firm as if produced by the hot-cautery. I found this to be fallacious by the return of patients with unmistakable signs of stenosis upon whom I had used electrocoagulation a year or more before. Not perhaps to the extent of producing pyometria, but with premenstrual distress and low abdominal tenderness — a mild peritonism. This condition was usually readily relieved by applying negative galvanism through the proper electrode in the cervix. With ionizations I have not met this difficulty.

I have devised a set of intracervical electrodes for application of copper ionization and subsurgical diathermy. By subsurgical diathermy is meant what is called medical diathermy by Robinson and Cumberbatch. It is not

a destructive current, such as is the coagulating type of the high frequency current. It is non-destructive, non-bactericidal in the usual sense except for the gonococcus. This current produces congestion and increased blood supply to the cervix, opens the ducts of the racemose glands and promotes drainage. The same electrode when connected to the galvanic unit is used advantageously for ionization. For the latter the dispersing electrode (the metal plate used for the diathermy or high frequency current) must be changed to a wet pad. The special construction of the intracervical electrode admits of easy adjustment. The shoulder permits just the right penetration into the urethra and cervix. They come in three sizes, so as to permit of snug fitting in the cervical canal.

Inasmuch as seances for ionization and subsurgical diathermy require from ten to thirty minutes, it is necessary to have a holder, as otherwise it will require the undivided attention of an attendant. By the use of this device, the electrode is placed *in situ* and requires only casual supervision during the treatment.

Before beginning intracervical treatment it is absolutely necessary to make a thorough diagnosis of the condition of all pelvic organs. This treatment is not a cure-all, nor is it an innocent plaything but a potent therapeutic measure capable of doing harm as well as good.

In cases with appreciable tenderness of or around the uterus, it is best to begin treatments with a vaginal electrode placed behind the cervix. A few applications usually suffice to ameliorate the sensitivity.

Summary

Nearly all of the inflammatory diseases of the uterus, tubes, ovaries and parauterine structures originate from an infected cervix.

Endocervitis and cervicitis is as important a factor as teeth and tonsils in focal infections, manifested by such somatic conditions as general ill health, fatigue, headache, backache, arthritis and cardiovascular disease.

Cervical infection is present in 80 per cent of women between 20 and 50 years of age.

Radical methods of treating cervicitis, such as extensive cauterization or amputation are rarely indicated, and should be avoided because they disturb the physiologic balance of the uterus during the childbearing period.

Mild electrocoagulation (surgical diathermy) with a bulb-tipped applicator beginning at the internal os is best for the average case with erosions.

Copper or zinc ionization is indicated in many cases with prevailing local symptoms, such as leucorrhea, bleeding, and backache.

Subsurgical diathermy is advocated for systemic symptoms, backache, arthritis.

Vaginal diathermy for tenderness in the pelvis and peritonism, or, as preparation for more active treatment of cervicitis has proved of value.

Discussions

(Drs. M. A. Roblee and William E. Ground papers)

Dr. W. E. Keesey (Chicago): I should like to have Dr. Ground give us a little more of the technic of his ionization treatment of the cervix.

Dr. Frank Walke (Shreveport, La.): I don't know of anything that is more embarrassing than to find a patient whom one has treated for cervical infection by conventional methods not to be relieved of her discharge. I was very gratified to hear that Dr. Ground used the dual method of ionization and surgical diathermy. In my opinion, that is probably the best method and is the one which has given me the most success in treating these particular cases. Above all things we must obtain drainage of the cervix. Drainage of the racemose glands is essential and, in my opinion, this can be best accomplished by galvanism. It is proper

to coagulate and heat the cervix as much as possible and then finish with the ionization method. That is a most ideal treatment in this particular type of cases.

Dr. T. P. Haslam (Council Grove, Kan.): I am keenly alive to the necessity of early diagnosis, and I was hoping to get a little more information in regard to that. Unfortunately, I missed the first part of Dr. Roblee's paper. Perhaps he discussed that. The German literature mentions an instrument, essentially a cystoscope, for examination. I notice that very often we have an absolutely clear mucoid discharge from the cervix. I can hardly reconcile that with any active inflammation. There are no pus cells in that discharge. Lower down in the vagina we find, of course, in many of those cases, a mixed flora, particularly if the vagina has become alkaline so that Döderlein's bacillus no longer dominates the flora.

I asked Dr. Roblee for particulars with regard to the severity of the secondary hemorrhages in the ambulatory cases and his method of controlling them. I trust that Dr. Ground will inform us as to the number of subsurgical diathermy treatments combined with ionization that he finds necessary in the average case, particularly how, before he does the treating, he picks out the cases similar to the last one which he said the mild treatment would do no good and for which he advised the vaginal hysterectomy.

Dr. Harold Swanberg (Quincy, Ill.): I should like to have Dr. Roblee explain how many days after electrocoagulation he dilates the cervix.

Dr. M. A. Roblee (closing): May I answer in reverse order. After the cervix is healed, that is, six to eight weeks after the surgical diathermy procedure, the canal is gently dilated. In regard to control of secondary hemorrhage, we pack with acriflavine gauze. It is a good sized vaginal packing, sometimes five yards of two and one-half inch gauze, which remains twenty-four to thirty-six hours. Two cases required transfusion. Any case that had a red blood count of under three million or hemoglobin under sixty per cent was transfused. Those were all clinic cases. There were some private cases in the group, but the private cases were all done in the hospital. The 350 represent clinic cases, followed with a five-year study.

As to cancer diagnosis, I used the Schiller iodin stain to show where the biopsy specimen should be taken. That is, an area of the cervix that does not take a full deep mahogany stain. A white area is not necessarily a sign of cancer, but is the area from which to excise a specimen for biopsy. It has been our experience, after five years, that in an advanced stage of chronic cervicitis it seems necessary in most cases to remove the gland bearing area of the cervix.

Dr. William E. Ground (closing): In reference to ionization, one may use a liquid electrolyte or a solid stick. I use an electrode that has a zinc tip. It has a little shoulder that fits snugly against the external os. It is about an inch in length. This electrode is attached to the galvanic current. No other current will produce ionization except the galvanic current. Two or three tips of various sizes can be screwed on the same shaft. This is placed in the cervix and the galvanic current turned on. Sometimes I use a copper electrode. In fact, I think copper is just as efficient. There are many patterns of electrodes, but this one has different sizes to fit variously sized cervices.

Subsurgical diathermy simply heats the cervix. Copper electrodes are used by Dr. Robinson in his clinic. These are soft copper insulated by a piece of rubber tubing. It is simple and inexpensive.

Dr. Robinson's and Dr. Cumberbatch's technic for subsurgical treatment, or medical diathermy as they call it, was obtained something like this. The tip of the electrode is placed in the urethra, which is very often infected by gonococci the same as the cervix. The electrode is inserted into the urethra and the high frequency current turned on. The current is applied until the patient reports the urethra to feel warm. Then the current is gradually advanced until the patient complains of painful heat. The amperage is registered and maintained. The electrode is then withdrawn from the urethra after the current has been shut off, and the same instrument and same exposure is applied to the cervix. There is no intention of destroying any tissue. One produces hyperemia and drainage of the cervical glands.

When we resort to frank cutting, coring of the cervix, similar to a Sturmdorf operation, those patients are all in the hospital. The cored part is never left in the cervix. We core them out clean as far as we want to go and then pack the cavity with iodoform gauze and leave that in for three, four, five days or a week. In that way, one obviates the necessity of repacking, and the risk of hemorrhage is reduced to the minimum. I don't leave the cored out or necrotic part in the cervix.

(Continued from page 511)

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EDITORIALS

CLINICAL BACKGROUND OF SHORT WAVE RADIATION

In the scientific evaluation of the art of healing it has always been a problem whether theories should precede or follow clinical demonstrations. There is no doubt that the ideal is to be sought in a combination, one confirming the other. This especially applies to the present disputes concerning short wave therapy. It is understandable that with all physical and biophysical fundamentals of short and ultrashort waves admittedly not fully established, the theoretic interpretation of clinical effects should be lacking in uniformity. Clinical results *per se* are not always conclusive to justify the formulation of dogmas, because so many accidental factors may enter into the clinical picture as to leave room for doubt how much is due to specific effects of a given remedy and how much to *vis medicatrix naturae.*

Taking for illustration a case of syphilis, we know that improvements have been noted even without the administration of antiluetic specifics. This example can be multiplied with many other diseases, irrespective whether they are regarded as self limited or not. Yet no one will deny the efficacy of pharmacotherapy on such a basis. Pharmacotherapy both theoretic and clinical, rests on an established basis because of demonstrations on a vast scale of experimental and practical observation. It is in the mass that averages and not exceptions dictate conclusive acceptance. All this applies with equal force to present day short and ultrashort wave diathermy. It is a matter of common knowledge that the literature concerned with this new method has advanced contradictory theories more than concrete clinical evidence. Sufficient clinical material has already been presented to substantiate certain theories, at least in the hands of a few investigators to merit recognition. That the bulk of the medical profession is as yet in no position to verify all findings, lies in the newness of the method and in the far reaching differences of its physical and biologic characteristics, as compared with the ones of conventional diathermy. Under such circumstances the presentations of competent observers should be studied with an open mind. It will not aid progress in physical therapy to become entangled in polemics

involving minor and comparatively unimportant details, such as relation to thermic penetration at various depths, the nature of selectivity, or even the appropriateness of nomenclature. What actually has proved of value in advancing this special field of therapy is the study of concrete clinical evidence at hand. It is only after we have become convinced of the effectiveness of short waves in conditions which have not been benefited by conventional diathermy, or in which the latter agency is contraindicated, that there will be justification for the formulation of explanatory theories.

The noteworthy labors of men like Schliephake[1] and Jellinek,[2] resumés of which appear elsewhere in this issue, should be accepted as programmatic for our clinical efforts. In this respect negation, clinical as well as theoretic, advanced by authors of repute should be considered with a critical mind. It should not be overlooked that the reputation of an author gained in one field of endeavor does not render him an authority in alien fields. The objections, to illustrate, recently raised against Schliephake's findings by no less than Sir Leonard Hill and others, carry weight only to the extent that different methods of research necessarily must lead to different findings. Thus Jellinek's observations on new born mice, paramecia and vorticellae by weak thermoelectric fields demonstrate the lack of uniformity in experimental methods and consequent disagreement in interpretation of findings. In addition it must not be overlooked that there is much leeway in the grading of heat produced by electrical forces. Schliephake undoubtedly had this in mind when he pointed out "that in ultrashort wave therapy we are not dealing with heating effects in the common sense, as is still being asserted by some authors, but with a heat which often deviates from that of thermotherapy and diathermy."

In the last analysis we as clinicians are principally concerned with therapeutic effectiveness, though its scientific background, too, is a matter of concern. Clinically every competent practitioner is in a position to verify by personal observation whether or not Schliephake's astonishing cures of furuncles, lung abscesses, cholecystitis, and similar grave conditions, can be favorably influenced by properly dosed short wave diathermy without or as an aid to surgical intervention. The prime condition of such tests is that one employ wavelengths and methods of application which authoritative observers have found to be the most effective. Medicine like ancient Rome can be reached by more than one road. It is within the province of practical clinicians to ascertain which of the roads is the shortest and most convenient to reach the desired goal.

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IONIZATION IN NASAL ALLERGY

The problem of nasal allergy continues to baffle the medical profession. On the one hand the allergist endeavors to make a scientific diagnosis and then by specific therapy immunize the individual against the offending irritants. On the other, the rhinologist, disappointed with the results of specific immunization, resorts to non-specific measures, hoping by such means to render palliation if a cure is not possible. The allergist claims he produces good results. If we are to judge from the numerous cases which the rhinologist is called upon to treat, after injection treatment has failed, we cannot accept the allergist's claim as true. And, in fact, in some quarters, the allergist is willing to admit that in the perennial type of nasal allergy non-

specific methods frequently must be depended upon to give patients relief.

From the time hay fever was first recognized, investigators resorted to local procedures in the form of cauterization to render the nasal mucosa insensitive. Cauterization whether by chemical means or intense heat has come down to the present as an effective means of treatment and is still employed by rhinologists in spite of the fact that it entails a certain amount of tissue destruction. The employment of escharotics in hyperesthetic rhinitis is preferred by some investigators[1] who have found, in their experience, that chemical cauterization produces slightly better results than ionization. Of all the local procedures recommended, however, ionization stands out prominently as a therapeutic advance which merits serious consideration when the problem of nasal allergy presents itself. The numerous favorable reports from reliable investigators overshadow the inconspicuous few negative results from sources which possess only recent familiarity with a highly specialized technic requiring years of study to master properly.

The superiority of ionization over the other non-specific procedures can be readily ascertained by any interested worker. The clinical results are in many instances spectacular giving prolonged palliation to a large group of afflicted individuals irresponsive to other remedial agencies. That ionization should not be heralded as a cure has been pointed out by Hollender[2] who has found, however, that symptomatic relief may last for an indefinite period.

Aside from the clinical effects of ionization which are admittedly good in the large majority of cases, certain basic problems have been investigated in connection with the method. Wenner[3] found that zinc ions, although slowly moving, penetrate the skin; that zinc iontophores cause disturbances in the circulation of the blood through the smaller vessels and capillaries of the skin, and that the destructive changes in the skin following the procedure depends upon the strength and the duration of the current, the area of tissue treated and the concentration of the electrolyte.

Tissue changes in iontophoresis have been studied by Hollender,[4] Cottle,[5] Hurd,[6] Alden,[7] Smit[8] and others. The findings are in most instances similar with some question only as to the regeneration of cilia. This is an important consideration in relation to nasal function and should be settled eventually. The fibrosis which ensues must explain in part at least the clinical effects which result from the method, while other tissue changes are dependent altogether on the technic employed. Dean[9] believes that ionization acts by thinning and splinting the mucous membrane. He states that it interferes with the absorption of pollen through the mucous membrane of the nose. The columnar ciliated epithelium is destroyed and in its place is found a hyperplastic and metaplastic epithelial lining. The surface cells have a tendency to become squamous. There is a tendency for this metaplasia to disappear and ciliated cells to be again produced.

The question now resolves itself: Do the clinical results of ionization outweigh possible deleterious effects to the nasal mucosa and to nasal function? This question is not easily answered. Even Dean avers that ionization improves most cases of allergic rhinitis, but he contends also that it produces deleterious results in the mucous membrane of the nose which last at least two years. He emphasizes that ionization should not be used unless the benefits are greater than the deleterious results produced. Such reasoning is rational but uncalled for. Patients have been clinically free from symptoms but their noses have been functionally good. Is it not a fact that often the results of our scientific investigations mislead us in the practical application of a remedy? This has occurred under other circumstances and seems destined to occur again in connection with nasal ionization.

It would be unscientific to argue that caution is unnecessary. The ex-

perienced rhinologist requires no instructions along these lines. The patients must be relieved even at the expense of insignificant tissue changes. How many individuals possess perfectly normal nasal mucosas? Our mode of living under all sorts of conditions of climate and weather constantly produce alterations in our nasal tissue which must of necessity interfere with normal nasal function. Granting that tissue changes result from ionization, are these out of all proportion to the changes cited? Is it essential to perform a biopsy of nasal tissue to determine whether a patient has a complaint to offer of his condition? Or shall we be content with objective determinations?

The rhinologist must pass on this himself. He alone can judge whether a certain treatment is indicated. Experience with ionization is essential in expressing opinions on its merits or possible deleterious effects. While the results of scientific studies are refreshing and beneficial, immature reports by the novice on limited amounts of material are not only unfair but usually unwarranted. To perform ionization scientifically one should have at least an elementary knowledge of the physics of the galvanic current. Too many clinicians have attempted ionization without a differentiation in their minds between a galvanic current and a high frequency current. Like surgery, technic in physical therapy can be learned by rule of thumb. The master surgeon knows his anatomy; the rhinologist thoroughly qualified to apply ionization first acquires a knowledge of the different electric currents suitable for therapeutic purposes in the specialty.

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YOUR HOSPITAL AND PHYSICAL THERAPY

Every hospital except the very small ones should have a physical therapy department. Some may question such a sweeping statement. Let us listen to the opinions of outstanding physicians.

Dr. Harry E. Mock of Chicago states: "Physical therapy should not be limited to office practice or to the ambulatory case. It should start, in many instances, while the patient is still in the hospital, during the early days of his recovery; therefore, every modern hospital must be equipped with a physical therapy department supervised by a physician who understands this work and manned by trained technicians who can administer it."

"I look to the more general and intelligent use of physical therapy, not by physical therapists but by physicians, as the means of making the next great advance in fracture treatment," says Dr. Philip D. Wilson, New York orthopedic surgeon.

A St. Louis plastic surgeon, Dr. Vilray P. Blair, adds further: "The application of

physical and occupational therapy plays an indispensable rôle in the care of many patients who have to undergo extensive plastic repairs of defects."

One of Philadelphia's foremost internists, Dr. William Stroud, recently declared: "It is my sincere opinion that physical therapy must take its place at the head of the various forms of treatment directed toward arresting the progress of cardiovascular disease."

Finally, the chairman of the American Committee for the Control of Rheumatism, Dr. Ralph Pemberton, recently wrote: "The field of physical therapy is not only the oldest but one of the largest therapeutic fields in medicine, having application to a wider variety of conditions than is the case with almost any other single group of agents."

These statements could be multiplied indefinitely. Leading physicians today regard physical therapy as an indispensable adjunct to proper medical and surgical care of hospital patients. A hospital without a physical therapy department cannot fully serve the patient's welfare.

Furthermore, such a department is an excellent source of revenue. In a Middle Western hospital which averaged 108 patients daily the gross income for the past year from the physical therapy department was over $9,000, with expenses of about one-third this amount. Of course, the staff understands and uses physical therapy.

In considering the establishment of a physical therapy department the attitude of the staff must be clearly ascertained. Their thoughts on this subject may have changed considerably in the last few years. Over ten years ago the American Medical Association established a council on physical therapy to examine and pass upon physical therapy apparatus. This council has also undertaken a campaign for the education of the medical profession in the use of physical agents. Frequent articles in the medical journals, two editions of the "Handbook of Physical Therapy," and scores of scientific papers on physical therapy presented before medical societies have paved the way for the wide utilization of these fundamental measures.

Any hospital that does not have a physical therapy department should make a start soon. This need not involve large expense. A member of the council on physical therapy recently stated that heat, massage and exercise are the three most important agents for physical therapy. These physical agents can be used with little apparatus and even this can, if necessary, be made by hospital employees. Designs for its construction can be obtained from this magazine.

This does not mean that manufacturers' apparatus should not be used. The profitable physical therapy department previously mentioned is well equipped with such apparatus. Short wave diathermy machines, for instance, give a penetrating form of heat that cannot be duplicated by any other means. Ultraviolet radiation lamps are useful in many conditions.

But to start a physical therapy department expensive apparatus is not necessary. It is wise to spend the first money on good technical personnel even if they use homemade apparatus. As the department expands buy such apparatus as is required and will be used. The council on physical therapy issues a list of accepted apparatus. As physical therapy machines may be inefficient or dangerous the hospital administrator should restrict his purchases to approved products.

The most important factor in success is efficient personnel. The department should be in charge of a physician with real interest and some special training in physical therapy. Because so large a percentage of physical therapy is the use of massage and exercise which require a thorough knowledge of anatomy, physiology and pathology, the technicians should be graduates of approved schools of physical therapy.

The MODERN HOSPITAL thoroughly believes in the importance of this department. Articles have been and will be published on physical therapy departments in various hospitals. If these do not solve your problems, our consulting staff will help you on application. — *The Modern Hospital* **47**:38 (Aug.) 1936.

HOTEL RESERVATIONS

Members who wish reservations at rates lower than the Convention rates made by The Waldorf are to please send their reservations and a description of their requirements to the Reservation Committee — American Congress of Physical Therapy, Waldorf-Astoria Hotel, New York City. An effort will be made to obtain desirable accommodations for them. The hotel favored with the reservation, will be requested to acknowledge the same direct to the member of the Society.

(*Continued from page 526*)

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THE STUDENT'S LIBRARY

THE PATIENT AND THE WEATHER. By *William F. Petersen*, M.D. With assistance of Margaret E. Milliken, S.M. Volume I. *Part 2. Autonomic Integration.* Cloth. Pp. 781 with 366 illustrations. Price, $9.00. Ann Arbor, Mich: Edwards Brothers, Inc., 1936.

As stated above the present work is the second part of volume I and deals with the autonomic integration of the individual (the patient) to the changing meteorologic environment to which he must adjust himself in order to remain in good health. If the tribute paid the author in the review of the first part of the present volume was adequate for that issue, it is hardly sufficient for the appreciation of the book under consideration. Here indeed the author rises to a scientific and literary level seldom observed in contemporaneous, technical literature. One has to practice judicial reserve in order to avoid the appearance of overenthusiasm, even though there is more than ample justification for such manifestation. For here we have an encyclopedic monograph so erudite and so replete with data which though ancient in concept have virtually been recreated in a form of the greatest practical value to modern medicine. We need but quote a passage from the author's preface to obtain a digest of his fundamental thesis. It reads:

> The organism adjusts (itself) to the meteorological environment by the three major components of the autonomic apparatus — chemical, endocrine, nervous. What is apparently new in this ancient view is the determination that the organism swings in a definite rhythm of increasing and decreasing oxidation, of increasing and decreasing pH, of increasing and decreasing metabolism, of increasing and decreasing blood pressure, all clearly inter-related to the meteorological environment. What is perhaps also new is the recognition that, while the organism seeks to maintain a proper balance by such a rhythm in the normal biological process, the peaks and troughs are of clinical significance because here lack of prompt integration frequently leads to dysfunction, to disease, and *finally* to death.

There remains but to present a list of the principal chapters to give the reader an idea of the extensive labors involved and of the material covered. Though numerically the work is divided into fifteen chapters, most of them have subsections which are complete in themselves. Beginning with an exposition of the individual from the standpoint of his constitution and cellular response, Petersen treats the subject of atmospheric environment in its manifold variations. The study continues with consideration of the relation of atmospheric influence on human pathology, in which physical as well as mental phenomena are described and interpreted. Chapters dealing with the reactions of the organism as a whole and its constituent elements follow, the work concluding with a physiologic and chemical survey of climate and its cycles, the very last chapter being devoted to the human organisms as a cosmic resonator. Apart from the heroic effort mirrored in a work which should fill every physician with pride that an American colleague and scientist has outdone in scholarship and scientific exactness anything that has heretofore been published, the book is also striking in its typographic makeup, the bulk of which is in mimeographed style. This volume, indeed, is worthy of a place among the most honored contributions to medical science.

HAUTTEMPERATUREN (Skin Temperatures). By *Johannes Ipsen*, Dr. Chirurg., Dr. Med. Statshospitalet, Sønderborg, Denmark. Carton. Pp. 375. Price 18 Kr. Copenhagen: Levin & Munksgaard, 1936.

The clinical significance of skin temperatures is only now beginning to gain interest. It should be stated at the outset that the systematic observation of cutaneous temperatures is not merely a refinement of diagnostic precision, but a procedure which the author has demonstrated to be of utmost importance in the differential diagnosis of vascular and other affections. Ipsen is a pioneer in this field, for while measurement of the skin temperature has been practiced for a long time, he was the first to employ it systematically about 11 years ago, and by his many publications in Danish and German built a path through an uncharted field. Though he modestly presents his extensive study not as a monograph, but as a means of facilitating further study and clinical observations, careful perusal shows that it is a well rounded out work. Ipsen's studies embrace investigations under physiologic conditions, comparisons of temperature variations at symmetric sites in localized disturbances, and temperatures in systemic diseases. The methods employed (multiple thermometry, thermoelectric procedures, combined with oscillography) are discussed at some detail. Among the clinical chapters skin diseases, vascular affections, fractures, inflammation, phlebitis, and certain articular and nervous disturbances have been treated exhaustively, all based on a rich clinical material. In addition the author presents convincing observations on the relation of skin temperature to metabolism, fever, and narcosis and concludes with a survey of the practical value of this diagnostic procedure in surgical conditions. An extensive bibliography related to the subject and allied physiologic studies and an index conclude this important volume. We can think of no more impressive way to convey an idea of the clinical and scientific value of this book than to express the hope that some enterprising American or British publisher will undertake the publication of the book in the English language.

LES ONDES COURTES EN THÉRAPEUTIQUE (The Short Waves in Therapy). By *Jean Saidman*, Founder-Director of the Institute of Actinology, and *Jean Meyer*, Chief of the Laboratory of Finsen Therapy at the Hospital St. Louis, Paris. Carton. Pp. 274. Price Fr. 40. Paris: G Doin & Cie. 1936.

This contribution to the literature of short wave therapy comes prominently introduced by Professor d'Arsonval. The principal author is noted as a pioneer in this new field and as the first author to present a monograph, in 1931, giving his observations and clinical experiences with short wave radiation extending over a period of about five years. That monograph was written with the collaboration of R. Cahen, who in the present entirely new edition has been replaced by a man well known not only as a heliotherapist but as one of the first workers in France to make clinical use of short wave diathermy. The text presents a brief history, the physical properties of the short waves, and a rather lengthy discussion of apparatus and electrodes with especial reference to those manufactured in France. The physical phenomena are treated tersely but adequately and are followed by an exposition of experimental findings on animals and of the effects of short waves on normal humans. An interesting feature of this book is a rather extensive study of the effect of wavelengths and electromagnetic fields without or with very insignificant thermogenic properties. The clinical considerations, grouped as local applications and as systemic treatment (electropyrexia), cover the ground adequately. The authors have freely quoted the opinions and conclusions of other authorities and concede that there are still many problems awaiting solution. Though the work stresses what may be referred to as the French school, the general literature has not been ignored, so that the work is a fairly comprehensive exposition of the present status of short wave therapy. Considering the scientific reputation of the authors, one is keenly disappointed in their bibliography. Apart from the fact that quite a number of noteworthy contributions have not been mentioned, most titles of foreign articles have been so misprinted as to represent jumbled type and to render identification utterly impossible. If a bibliography is to facilitate readers in finding sources for collateral study, the one here available is worse than useless. True to form of many foreign works there is also no index. It is hoped that in a next edition these shortcomings will be remedied, in keeping with the scholarship of the text.

ETHIOPIA. By *John H. Shaw*, Consul General of Ethiopia. Pp. 95 with 30 illustrations and 2 maps. Price, paper covers $1.00, cloth bound, $1.50. Published by the Author, at 78 Water Street, New York City. 1936.

The author of this small but highly informative book is a distinguished American business man who for some time has been the sole diplomatic representative of Ethiopia in the United States. Having traveled extensively and traded with the Ethiopians, he has made an impartial study of them and their country. Although evidently prepared to remove many misconceptions, the book is by no means polemical in character, but a simple, one might say, narrative of the legendary and actual history of the nation, a popular description of the terrain, climate and natural resources of the country, and finally a survey of the international diplomatic relations, beginning with the entry of Ethiopia as a member of the League of Nations and terminating with the Italian imbroglio, all of which is supported by documentary evidence in the form of pacts and treaties. Shaw pays tribute to Emperor Selassie as an educated linguist who tried to afford the benefits of civilization to his people. We learn that the Emperor brought to the country a number of physicians and subordinate personnel and endowed hospitals, sanatoria and a leprosarium. We learn something of the Amharic language, of the money used, and of the general development of the country in commerce and of the resources, the author conceding that some still are of necessity in a primitive state. Ethiopia is at present in the limelight as a possible storm center that may affect the peace of the world. Under the circumstances this book, written in simple language and entirely devoid of technicisms which has all the earmarks of authority, should be perused by those who desire to become acquainted with a part of human history and an extensive country in Africa, which is scarcely known by Americans.

Mexican Society Honors Dr. Thorek

At the meeting June 12 of the Academy of Surgery of Mexico, Doctor Max Thorek of Chicago was elected an Academician. The insignia was bestowed by the American Embassy at Mexico. His friends felicitate him on his new honor.

Correction

In the review of Dr. Spivack's book in the July issue the price of the book has been misprinted as $1.00. While this typographical error has no doubt become evident to readers of the review, we beg to correct the misprint to read $10.00.

INTERNATIONAL ABSTRACTS

Electrosurgical Cholecystectomy II. Clinical Application. Lester B. Whitaker.

New England J. M. **213**:674 (Oct. 3) 1935.

The clinical results on sixteen cases of electrosurgical cholecystectomy by a special method previously worked out on animals are presented. Essentially the method is as follows: The gallbladder is split to the cystic duct which is tied; the redundant portions of the gallbladder are removed by the electrosurgical "cutting current"; the part of the gallbladder remaining attached to the liver is thoroughly coagulated. The gallbladder best adapted to this method is one markedly inflamed or sclerotic. The method is not so safe or so effective in the non-thickened gallbladder; and the patients should be carefully selected with this point in mind. The preferable current is the biterminal coagulating; contact should be made by the active electrode and the tissue treated to considerable depth. The tissue-dissolving or "cutting current," and the uniterminal or "desiccating current" are not recommended for the treatment of the section of gallbladder left attached to the liver.

There were three deaths in the sixteen cases; none of them could be definitely related to the use of electrosurgery. The other patients made uneventful recoveries, for the most part with few complications; and the final results in all have been satisfactory, some of them having been followed for two and three years.

The question of drainage is discussed in the body of the paper: Where there has been considerable coagulated tissue left in place; where there has been pronounced inflammatory reaction; and where it has not been possible to tie the cystic duct securely, it has seemed advisable to drain. The type of drain has been the soft rubber tube inserted or attached to the stump of the cystic duct; or the rubber dam cigarette drain (Penrose), with no exposure of gauze. When the above principles are adhered to in carefully selected cases, those with markedly inflamed or sclerotic gallbladder, the method is recommended.

Value of Breathing Exercises in Asthma. J. L. Livingstone, and M. Gillespie.

Lancet **2**:705 (Sept. 25) 1935.

Livingstone and Gillespie assert that, in 75 cases of asthma treated for one year with expiratory breathing exercises, good clinical results were obtained in 52, improvement in 12, and no improvement in 11 cases. The improvement seemed to depend on the patient acquiring mobility of the chest, natural diaphragmatic breathing, and control of the diaphragm. The treatment requires perseverance on the part of the patient and the physician over a considerable time. A number of patients were able to abort impending attacks by these exercises; this appeared to be especially due to loosening and expulsion of mucus. This method is simple and applicable in all cases, and physiologically sound. Eleven patients were unable to learn diaphragmatic control. Specific treatment should not be neglected — i. e., removal of feathers or of foods, or operation in gross nasal disease. — [Abst. J. A. M. A. **105**:21 (Nov. 23) 1935.]

Results of the Treatment of Hydrocephalus by Endoscopic Coagulation of the Choroid Plexus. Tracy J. Putnam.

Arch. Pediat. **52**:676 (Oct.) 1935.

The instrument consists essentially of a rod of optical glass eighteen centimeters long and approximately seven millimeters in diameter, with polished ends which serve both as shaft and as viewing system. The illuminating system consists of a bronchoscope light and carrier fitting in a groove in the rod. Two electrodes are carried in smaller grooves to the tip of the instrument, where they lie exposed in the field of view.

The advantages of this instrument are several. There is practically no space wasted in the cross section; all of it except the electrodes is devoted to the transmission of light. It can be used in a cloudy medium. It has no focus. Structures in the ventricle may be seen at a distance of several centimeters, or in direct apposition. Nothing projects beyond the field of vision. The current passes only between the two electrodes so that the danger of damage to the walls of the ventricle is slight. The operator can watch and control the degree of coagulation of the plexus.

By means of a new instrument, it is possible to destroy the chlorid plexus of the lateral ventricles without draining the cerebrospinal fluid, through a small triphine and cortical incision. Bipolar coagulation is used, so that current does not pass through the basal nuclei. A far better view of the operative field than with other endoscopes is obtainable. The operation has been performed forty-three times in twenty-two practically unselected cases with seven hospital deaths. Of nine patients surviving for periods of four to fifteen months, five are in satisfactory physical and mental condition, two are improved but still feeble minded, and two have continued to deteriorate. In two recent cases the results are still uncertain. Among the last ten cases operated upon, there has been only one hospital death. Cortical atrophy appears to take place slowly in most cases of unrelieved infantile hydrocephalus. The commonest cause of mental defect in such cases is a concomitant cortical aplasia or other congenital malformations of the brain.

Electrotherapeutic Measures in Benign and Malignant Skin Diseases. Everett C. Fox.

Texas State J. Med. **31**:402 (Oct.) 1935.

Electrodesiccation produces a dehydration of cells with subsequent mummification. It can be used to great advantage when the lesions are superficial and good cosmetic results are essential. This type of endothermy is used in the treatment of nevi, verruca, leukoplakia, molluscum contagiosum, xanthoma, seborrheic and senile keratoses and superficial cutaneous malignancies.

Removal of verruca of the skin and mucous membrane by electrodesiccation can be obtained with facility. Only slight pain occurs with the infiltration of novocain into the base of the lesion. The needle is applied with slight current over the surface until desiccation occurs and then may be introduced into the upper portion of the lesion for slight coagulation effect, at which time the lesion will frequently balloon or swell and is easily removed with curved scissors. The base is removed by curettage and a second light desiccation applied. Careful debridement of the free edges is essential to prevent an accumulation of exudate and infection.

Nevi may be removed with better cosmetic results by carefully selected electrotherapeutic measures than by surgical excision. The nevus is infiltrated with 1 per cent novocain and desiccated, carrying the process only so far as is necessary to eradicate the lesion. The desiccated material is removed with a curette and the base lightly desiccated to prevent oozing. If the destructive process has not been too extensive a smooth, pliable, non-contractile scar will be the only evidence of removal.

Electrocoagulation is valuable for the coagulation of nodular areas of skin tuberculosis, infiltrative cutaneous skin malignancies, particularly those that are extensive and in the treatment of large angiomas. Where considerable coagulation is produced it is frequently advisable to excise the coagulated area with the cutting current and allow the excised area to heal by granulation. This is frequently a valuable procedure in the treatment of prickle cell carcinoma, but particularly melanocarcinoma. In melanocarcinoma an area of coagulation peripheral to the tumor mass is first carried out, and then the more central portion coagulated, and finally this entire coagulated area may be excised with the cutting current. This is a very safe procedure for destroying malignancies such as melanocarcinoma and cutaneous sarcoma.

The physician finds use for the cutting current in removing accessible neoplasms such as epitheliomas of the skin, tongue and lips, and the removal of tissue with the endothermy loop for microscopic study, and other superficial lesions requiring surgical removal.

Papilloma of the tongue or a small patch of leukoplakia may be quickly removed with the cutting current, using the endothermy loop, and after removal the base is lightly desiccated. Prickle cell carcinoma of the lip is more safely excised by the cutting current than with the scalpel.

Two Cases of Early Carcinoma of the Larynx, and a Number of Cases of So-Called Adenoma of the Bronchi, Apparently Cured by Diathermy. John Devereux Kernan.

Laryngoscope, **45**:760 (Oct.) 1935.

Emphasis is placed on the early diagnosis of carcinomas in the larynx and in other regions of the body.

The present report attempts to evaluate the result of several methods in the eradication of tumors of the larynx. The series consisted of ten cases: two of these ten, following lobectomy, proved fatal, although the tumor growth had been completely removed. Of the other eight, one recovered spontaneously, one was relieved of her symptoms by x-ray, and six were cured by diathermy, with radon seeds in addition in two of the cases. There has been a mortality of 20 per cent in ten cases, due, however, to lobectomy, rather than to application of diathermy through the bronchoscope.

Tissue Heating by Short Wave Diathermy. Bernard Mortimer and Stafford L. Osborne.

J. A. M. A. **104**:1413 (April 20) 1935.

Experiments have been performed on twelve anesthetized dogs and on the thigh of eight human subjects to study and measure the heating effects of short wave diathermy and to observe any other changes that might occur. Five short wave machines were used, a 6 meter, 15 meter, 16 meter, 24 meter, 25 meter and the conventional spark-gap diathermy.

There is no conclusive evidence from the literature nor were the authors able to substantiate the claim of specific biologic action of high frequency currents (short wave diathermy). In their opinion the burden of proof lies on those who claim any biologic action of these currents other than heat production.

The experimental work that claims specific bactericidal action for these high frequency currents may be more rationally explained, we believe, on the basis of "point heating," which raises the temperature of the microorganisms above their thermal death point without a corresponding elevation in the temperature of the medium. It still remains to be demonstrated whether such test tube results can be secured with infection in the body. On the machines submitted, here is a thermal gradient from the hot skin to the less hot tissues within. There is no evidence from reliable experimental work on living subjects that short wave diathermy possesses a more uniform penetration of heat into the body than the conventional diathermy. The possibility of special selective thermal action is a very remote one. Mortimer and Osborne do not believe that it is possible to predict the response of the body to high frequency currents from phantom mode or other *in vitro* experiments.

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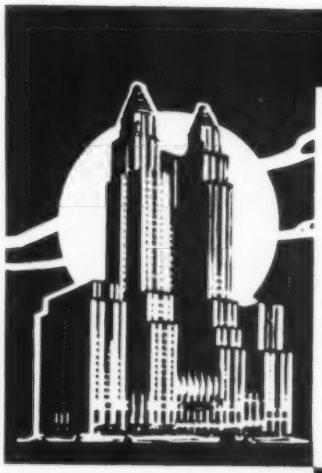

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ELECTRICITY AND MEDICINE *

WILLIAM BIERMAN, M.D.

NEW YORK

We are living in an electrical age. Electricity today plays as great a rôle in the science and art of medicine as it does in the correlated technical sciences and in the great industries that have aided in raising civilization to its present high state of development. Without electricity our system of rapid transportation, lightning like transmission of visual and auditory messages, and execution of mechanical labors involving the expenditure of tremendous physical energy would be virtually impossible, at least not in a degree available at this time. And all these forces which we owe to the development of electricity have revolutionized medicine, so that it has evolved from the crudest empiricism to a system of utilizing agencies which can be controlled practically with mathematical precision. It is, indeed, a far cry from the first discovery of magnetism produced by rubbing of amber to the powerful dynamos that provide whole communities with brilliant illumination and which have outstripped in efficiency the energy produced by steam, and it is an equally far cry from the first empiric observation that dissociate metals produce muscular contraction to the development of complicated apparatus created by the ingenuity of electrical engineering by which biologic processes can be influenced in a therapeutic sense even without immediate contact with living bodies. It is not my intention to even sketch the historical development of medical electricity, but I am constrained to invite your attention to the first insight into the exact nature of electrical phenomena obtained when Crooks examined his cathode rays and when a little later Thomson found them to be particles, smaller than atoms, which Stoney called *electrons* and which Rutherford recently identified as *protons*.

If I may be permitted to do so, I would add my own concept of electricity as a phenomenon which grew from the first feeble spark produced by Otton Von Guericke to the present type of radiation, and from the beginning to the end is related to natural forces manifesting themselves as rays from the sun and moon, as atmospheric discharges, as radio activity, as chemical reactions, nay, as life itself. Accordingly we may describe electricity as the prime material that forms all substance, from the merest atom of hydrogen to the huge constellations in the universe.

Leaving these abstract considerations for our concrete and practical problems, we recall that up to about twenty years ago the progress made in the application of electricity for diagnostic purposes had outstripped that for therapeutic efforts. This was in part due to the greater stress upon diagnostic precision to be attained by roentgenography, cystoscopy, electrocardiography and similar procedures. This trend certainly resulted in a concept of therapy which is best described by the single word — nihilism. Fortunately the pendulum has swung back in the direction of therapeutic activity, with the resulting increase of interest in the clinical management of disease in which physical therapy has gradually assumed and continues to assume decided prominence.

To those amongst us who feel that physical therapy is a new specialty, let me point out that it is as old as medicine itself. In the early heliolithic cultures when priests were the healers and medicine was based on superstitious beliefs, the sun was an important agency in treating disease. The

* Presidential Address delivered at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 8, 1936.

empiric use of the electric current dates back to the time of Christ. During that period the electric eel was used by Mediterranean peoples to relieve pains and aches. The systematic employment of various electrical phenomena in therapy, however, had to await the accumulation of accurate knowledge in the domains of etiology, pathology, physiology and electrical engineering. Accordingly scientific physical therapy may properly be regarded as of comparatively recent date.

To us physicians who live in the present electrical era and specialize in physical therapy has fallen the lot to develop this discipline. Today we have at our command a number of electrical procedures which have proved valuable in the treatment of many and diverse diseases. These include, in addition to the application of radium and x-rays, ultraviolet, luminous and infrared radiation, the short wave and diathermy high frequency, the static and galvanic currents, and their modifications. The use of electricity in medicine is rapidly expanding. It has also greatly extended the ability of the surgeon to cope with malignant neoplastic disease, with lesions of the brain and of other organs difficult of access by classic methods.

When this Congress was organized in 1921 it had, in addition to encouraging the current application of the knowledge of physical therapeutic procedures possessed at that time, two tasks that were also the responsibilities of every physician, namely, the stimulation of research and protection against pseudo-science and downright charlatanry. It is to the everlasting credit of the small group of men who first led this body, that they recognized these responsibilities and had the courage born of conviction to struggle for the scientific recognition of physical medicine.

Taking for purpose of illustration the development of diathermy in the earlier days of the present century, it will be recalled that the experience gained in the World War gave rise to a large group of mercenaries, both in and beyond the profession who exploited the spectacular use of electrical apparatus. Fantastic claims and untruths were spread for unethical motives. The danger that arose from such practices to our specialty is obvious. Untrained lay individuals attracted to electrotherapy for its material revenues added to this.

Let me quote here from a recent report in the *Journal of the American Medical Association on the state of affairs existing about ten years ago.*

"At that time there were certain conditions in the realm of physical therapy that threatened its ethical standing with the profession as a whole. Many new pieces of apparatus had been introduced and many over-enthusiastic statements had been made and published by those who were becoming addicted to an untried machine therapy. . . .

"The Committee desires to warn the profession as a whole against the acceptance of enthusiastic statements from manufacturers' agents — salesmen absolutely untrained in medical sciences. While the committee feels that, for the most part, the sales agents and manufacturers of physical therapeutic equipment are no less trained and no more over-enthusiastic than representatives of many drug and surgical supply houses, nevertheless physicians are warned particularly against the high pressure type of salesman of physical therapy equipment who extols his device in terms of earning ability."

Reputable manufacturers of apparatus have been of considerable assistance to the physician in his effort to administer physical therapy by providing him with adequate means. However, there are many whose principal interest is in the direction of economic gain and who are least concerned with the quality of their products and with their correct and ethical uses. These concerns have been supplying equipment, much of it of inferior qual-

ity, to clubs, gymnasia, beauty parlors, radio advertisers and others of their like. Can there be any doubt that the objective of the individuals conducting these establishments is identical with that of disreputable manufacturers?

For the attack upon the hordes of the mercenary charlatans, a small group of ethical physicians have taken the initiative in the interest of organized medicine. This group merits the full support of the entire medical profession. Unfortunately for all concerned these men all too often have not been accorded the proper support by our own ranks, and have been subjected to an insidious antagonism born of prejudice and failure to appreciate the importance of the problems affecting scientific physical medicine. As a result the profession virtually throughout our land finds itself harassed by a twilight profession pretending to possess qualifications expected of regular practitioners. In New York State alone an authoritative investigation has revealed that out of 452 so-called registered physiotherapists only 34 had complied with the legal requirements, the remainder having obtained their licenses by mandamus proceedings or by other questionable methods. Included in this group were chiropractors who misused their certificates to cover the illegal practice of medicine. Truly a situation that should arouse the medical profession to concerted action.

I need not stress the dangers to the sick whose lives are entrusted to the tender mercies of these unqualified laymen without supervision by physicians. Under the laws of some states, it is possible for ignorant individuals, after a few weeks cramming for an examination, or by the employment of unscrupulous legal talent, to obtain a license as "experts in this field." How great a toll this situation has already taken is impossible to estimate. Yet until recently little recognition has been given to this pressing problem. The time has come for its solution. Fortunately, measures are being taken to correct this evil.

Under the aegis of this Congress, a registry of capable technicians is being developed. These technical assistants are well trained and qualified to aid the physician in his application of physical therapeutic measures.

If treatment at the hands of inadequately trained individuals is deplorable, what are we to say about self-treatment by laymen? Yet every day over the radio in this city, audiences are exhorted to apply diathermy for numerous diseases without medical advice. The physician, no matter how experienced and skillful he may be, frequently encounters difficulties in the diagnosis and treatment of disease. These radio spellbinders appear to be taking the place of the silver-tongued gentry who, from their horse-drawn wagons, harangued gullible listeners to purchase colored lotions with the miraculous powers to cure almost all human ailments. The number of radio listeners far exceeds that of the small groups who used to gather around the tailboard of an itinerant patent medicine barker's wagon. Radio auditors are supposed to be able to make their own diagnosis and to treat themselves with some remarkable diathermy machine — rented to them at so many dollars a month. How long will the radio commissioners permit this form of prostitution to go on? When will they assume responsibility for the ultimate fate of the deluded human sufferers who, convinced by the apparent sincerity of a good radio voice, permit themselves to be so grossly exploited? It is a blot on our supposedly enlightened society that such radio advertisements are allowed to continue.

The active cooperation of every member of the Congress is necessary in helping to overcome the difficulties which beset us.

But these matters have constituted only one part of our responsibilities. It behooves us not only to be good clinicians, but because of the growing importance of our specialty, to devote ourselves to another important field —

the scientific establishment of facts. To this we must work with care and precision.

In the fifteen years during which the Congress has existed, its influence has grown. This has been reflected in the progress made by our specialty in the field of electrotherapy. We may point with just pride to the evolution of artificial fever therapy and of short and ultra-short wave diathermy.

In therapeutic fever produced by physical agents we have at last found a specific procedure for gonorrhea in the female and for gonococcal arthritis. Perhaps it is also the long-sought weapon with which we shall be able to combat syphilis. Those accomplishments alone have justified all the effort that has been expended in recent years in the development of our specialty. For the most part, they are accepted by physicians engaged in other specialties.

There is no need for me to urge you to search for the truths and to eliminate the half-truths in physical therapy. The increasing interest shown by medical schools and practitioners throughout the country in under-graduate and post-graduate instruction is an index of the success with which we all have carried out our task. Let me emphasize, however, the importance of an intensification of research so that knowledge in our field may be further increased and our technics may rest on scientific data rather than on empiricism. To do this more effectively, it is necessary that we obtain the cooperation of other specialists, notably, the physiologists, bacteriologists, biochemists and pathologists. Our colleagues in other branches of medicine have begun to appreciate our efforts to aid them and their patients. The old attitude of hostility, although still evident in some places, is gradually being dissipated by an accumulation of incontrovertible facts.

We are indeed living in an electrical age. And the promise of the possibilities of the application of this mysterious force in the medicine of the future is as bright as the illumination created by the current itself.

PHYSICAL AGENTS IN TREATMENT OF CIRCULATORY DISEASES OF EXTREMITIES *

NELSON W. BARKER, M.D.

Division of Medicine, The Mayo Clinic

ROCHESTER, MINN.

The physiologic disturbances in circulatory diseases of the extremities involve several physical and mechanical factors. It is not surprising, therefore, that almost from the time that these disturbances were recognized attempts have been made to combat them by various measures of physical therapy.

The most common of the peripheral circulatory diseases in which physical therapy is employed are the chronic occlusive arterial diseases, thrombo-angiitis obliterans and arteriosclerosis obliterans. Thrombo-angiitis obliterans is a recurrent, segmental, inflammatory, obliterative disease of arteries and, to a less extent, of veins, affecting almost exclusively males under the age of fifty years. Arteriosclerosis obliterans is a more or less progressive, degenerative disease affecting only arteries, associated with episodes of thrombosis, and affecting individuals of both sexes (males 75 per cent), usually after the fiftieth year.

* Read at the Mid-Western Sectional Meeting of the American Congress of Physical Therapy, The Mayo Clinic, Rochester, Minnesota, March 4, 1936.

It may be associated with diabetes mellitus. In both of these conditions there is chronic ischemia of the limb, which may vary from time to time with the stage of the disease. The ultimate result usually depends on the rapidity of development and the extent of the vascular lesions against the possibilities of development of collateral circulation. In both conditions intermittent claudication, rest-pain, ischemic neuritis, sensitivity to cold, ulceration, and gangrene may appear. Other less common peripheral arterial diseases in which physical therapy is used are arterial embolism, simple arterial thrombosis, and frost bite. Physical therapy is of little, if any, value in the primary vasospastic disturbances, such as Raynaud's disease, but is used occasionally in acral scleroderma. A few physical measures are used in treating the various types of thrombophletitis. In this condition, of course, one is dealing with congestion rather than ischemia; the two present quite different problems.

Problem of Therapy

One can consider the problem of treatment in a given case of organic peripherial vascular disease from three standpoints: first, from the local vascular lesion, which passes through various phases and finally heals with more or less permanent obstruction of a particular blood vessel; second, from chronic ischemia or congestion of the tissues of the extremity distal to the vascular lesion; third, from tissue lesions which occur secondarily to this ischemia or congestion (often plus local trauma), namely, ulceration, gangrene, infection, lymphangitis, and cellulitis. It is doubtful that physical therapy has much influence on the evolution and involution of the vascular lesions themselves and only a few simple procedures seem to be of value in the local treatment of the secondary ulceration, gangrene, infection, and cellulitis. Physical agents however are considered to be of definite value in the treatment of acute and chronic arterial insufficiency of the extremity as a means of increasing the blood flow through an already damaged circulatory system. The objective of such treatment is, first, to produce vasodilatation of the arteriolar bed, which may be either in a condition of spasm or of normal tone, and, second, to widen the collateral arterial channels which exist as an anastomosis around the point of vascular occlusion. One can liken this to a highway system where the detours around a blockaded portion of a main highway are widened and improved so that the delay in traffic can be reduced as far as possible. The rate at which the collateral circulation is improved is probably dependent to a certain extent on the production and maintenance of vasodilatation.

Misuses of Physical Therapy

Before proceeding to a discussion of the different physical agents, I wish to emphasize some possible misuses of physical therapy and the contraindications to certain measures in the treatment of vascular disease. The skin and tissues of an extremity suffering from chronic ischemia are very vulnerable to mechanical, chemical, or thermal injury. A recent study revealed that the precipitating cause of ulceration and gangrene was some minor injury in approximately 50 per cent of a series of cases of thrombo-angiitis obliterans and anteriosclerosis obliterans. In some instances this injury was accidental, but in the majority it was attributable to ill-advised therapy. Mild excesses of heat, cold, friction, and chemical irritation, as well as minor surgery which would not damage tissues with a normal blood supply cannot be tolerated by ischemic extremities without the occurrence of some local necrosis. If the ischemia is acute and is attributable to recent arterial occlusion, the vulnerability of the extremity is even greater than if the ischemia is chronic. Extremities suffering from acute or chronic congestion caused by venous occlusion are also abnormally vulnerable to superficial injury, although to a less extent.

The use of cold in any form has no place in the treatment of vascular

diseases except in the immediate thawing of frostbite and in those rare cases of cold allergy, described by Horton and Brown, in which immersion of the extremity in ice water for increasing periods is used as a procedure of desensitization. A possible exception is the employment of contrast baths, but in this procedure the contact with the cold water is restricted to periods of less than one minute and is followed by contact with hot water. Cold causes vasoconstriction whether applied locally or generally. It, therefore, increases ischemia and slows the blood flow. In cases of thrombophlebitis cold also slows the flow of blood, favors extension of thrombosis, depresses tissue metabolism, and lengthens the period of involution and organization of the thrombus.

Massage has little or no value in the treatment of ischemic or congestive diseases of the limbs. Furthermore, the unavoidable mechanical manipulation of blood vessels during massage may precipitate thrombosis.

Application of excessive local heat is definitely dangerous and is contraindicated in the treatment of ischemia of a limb. Direct application of hot objects—hot water bottles, electric pads, hot wet packs—has caused burns and subsequent gangrene in many instances of arterial disease of the extremities. This is particularly true in cases of acute arterial embolism or thrombosis where a cold, shrunken, pale, painful extremity seems to invite the use of heat. A safe rule is to keep the environmental temperature of an ischemic limb below 105 degrees F. and not to allow any hot objects to come in contact with the skin. The use of the heat chamber for the production of artificial fever and resultant vasodilatation is thus contraindicated because the ischemic tissues almost certainly will be burned by the high environmental temperatures.

Indications of Physical Therapy

The various physical agents which have been found to be of value in the treatment of vascular diseases of the extremities will be discussed from the standpoint of the method and not from that of the disease. The exact estimation of their value is difficult because one procedure alone is rarely used. Also, physical therapy is usually combined with other methods, such as vasodilatation by drugs, artificial fever (injections of foreign protein), surgery of the sympathetic nervous system, and, most important of all, rest in bed, so that it is often hard to determine the agent chiefly responsible for any improvement.

Radiant Heat. — This has been used in the treatment of ischemia of the extremities for a number of years. It was advocated by Buerger. Its rationale is the production of vasodilatation. Many forms of apparatus have been advocated, from the simple light cradle to the infra-red lamp. As has been mentioned, great care must be taken to watch the environmental temperature and to prevent burns. The most satisfactory apparatus to date is a wooden box which fits the end of the bed and over which the bed clothes can be spread. Light bulbs are placed in the corners and are carefully protected by shields from possible contact with the patient's feet during movements when the patient is asleep. A removable thermometer or a thermostatic control is fitted into the end of the box. The temperature best tolerated is 95 to 98 degrees F., and it can be maintained at a substantially constant level by this apparatus. Patients in bed under prolonged treatment can keep their feet and legs in this box more or less constantly. In the less severe ambulatory cases, the patients can sleep with their feet in the box and can use it for periods during the day.

Heat Applied to Distant Parts of the Body. — Gibbon and Landis have advocated immersing the forearm in hot water (113 degrees F.) or wrapping both arms in an electric pad covered by towels to produce vasodilatation in occlusive arterial disease of the legs and feet. They have demonstrated that vasodilatation of the toes occurs with such treatment, as is evidenced by rise of the skin temperatures of the toes. This is apparently attributable to efforts of the body as a whole to eliminate the extra heat and the vasodilatation stops

when application of the heat is discontinued. Such treatment should not be used in cases of thrombo-angiitis in which the arteries of the arm have been occluded.

Hot Soaks. — In the treatment of gangrene and ulcers attributable to ischemia, hot soaks have been employed extensively. All these lesions are infected and at their margins there are extensive leukocytic infiltrations and often collections of serum and pus which increase pain and delay healing. Drainage is often inhibited by thick sloughs and crusts. Soaking the extremity in warm solutions produces some vasodilatation and helps to loosen the crusts and to promote drainage. The temperature of the solution should never exceed 105 degrees F. Strong antiseptic substances should not be mixed with the solutions. Boric acid is commonly used since it will not dissolve in greater concentration than 8 per cent at the temperature named. Four or five soakings, for fifteen to thirty minutes each, may be used in a day, depending on the patient's tolerance and on the condition of the lesion.

Hot Packs. — In general, hot, wet packs should not be used on ischemic limbs, but they are of definite value in the treatment of acute thrombophlebitis of all types when combined with elevation of the extremity. It is advisable to grease the skin with petrolatum and to cover it with a thin layer of gauze. Small packs may be used over small areas of superficial phlebitis or secondary cellulitis. In cases of deep femoral, iliac, or axillary thrombophlebitis the limb can be covered with hot, wet blankets surrounded by a rubber sheet and hot water bottles can be placed outside the sheet to maintain the heat. Care must be taken not to burn the skin, although greater temperatures are tolerated by a congested than by an ischemic limb. At The Mayo Clinic, hot, wet packs have been found superior to dry heat in the treatment of acute thrombophlebitis, although the reasons for this are not clear.

Diathermy. — As a vasodilating agent, diathermy has had limited use. It has not been found to be superior to simple external application of heat and its effects do not persist after it is discontinued. There is probably some danger of burns if the plates are applied to ischemic tissue. There is no rational basis for the local use of diathermy through regions containing sympathetic ganglia.

Contrast Baths. — These have been used extensively for a number of years in the treatment of the chronic, occlusive arterial diseases, particularly in milder cases, on the rather questionable basis that the baths increase the development of collateral circulation. Some patients feel that their condition is symptomatically improved after a course of contrast baths, but their use is largely empiric and not based on any objective results. They should not be used when there is ulceration, gangrene, or trichophytosis, and the feet should be carefully and completely dried after each treatment to prevent maceration and cracking of the skin.

Postural Exercises. — These were advocated by Buerger and are often called the Buerger exercises. They have been used chiefly in the early or chronic cases of occlusive arterial disease when trophic lesions are not present. The method is to have the patient supine on a bed or cot and to instruct him to elevate his legs to a vertical position with thighs flexed and legs extended; he holds this position for one minute. He then swings his feet over the side of the bed and assumes a sitting position with the feet dependent; this position also he holds for one minute. He then lies supine with legs horizontal for one minute. The cycle is repeated five times for a total of fifteen minutes. A better technic is to individualize the timing by maintaining elevation of the feet until the more ischemic foot becomes blanched and to maintain the dependent position until the color has returned and the superficial veins have become distended. In some clinics vigorous inversion and eversion of the feet, when they

are dependent, are also advocated. The rationale of this treatment is to aid the development and enlargement of the collateral arterial channels. Clinical experience seems to endorse its value, but there is little objective confirmation. The exercises are easily learned and can be carried out two or three times a day for long periods.

Exercises With the Extremity Elevated. — These may be used in the treatment of chronic venous insufficiency of the limb following thrombophlebitis of large veins, but should not be attempted until at least four weeks after the thrombosis has occurred. To exercise the legs the patient lies supine, with legs elevated, and carries out bicycle riding movements for periods of one minute, alternating with periods of rest with the legs horizontal for one minute. To exercise the arm the best method is pulling a weight or some overhead resistance from the position of complete abduction of the arm, with elbow extended, down until the shoulder is abducted to an angle of 90 degrees and the elbow flexed to 90 degrees. It is known that muscular movements are one of the principal factors in promoting venous blood flow and that muscular movements, with the limb elevated, tend to aid in the development of the venous collateral circulation without subjecting the veins to undue strain and excessive pressure.

Intermittent Pressure and Suction (Passive Vascular Exercise). — Although the basic idea of this method of treatment has been known for many years, Landis, Landis and Gibbon, and Reid and Herrmann, deserve credit for having perfected the apparatus. They have described its use in a fairly extensive series of cases. Although the different types of apparatus vary somewhat, they all consist of a machine containing a pump and driven by an electric motor attached to an air-tight chamber or boot into which the extremity is thrust and which is closed at the upper end by a rubber cuff, which fits tightly on the skin of the thigh. Air pressure in the boot is alternately reduced to from minus 80 to minus 120 mm. of mercury and is raised to from plus 20 to plus 60 mm. of mercury. The usual cycle is fifteen to thirty seconds and the treatment is carried out for an hour or more three or four times a day. Definite redness usually can be noted during the phase of negative pressure and some transient vasodilatation is produced which is measurable by a rise in cutaneous temperature. Reid and Herrmann expressed the belief that prolonged treatment definitely increases the collateral circulation. There is some difference in opinion as to the clinical value of the treatment. The experience with the machine at The Mayo Clinic has been summarized recently by Allen and Brown. Various types of rest-pain occurring in occlusive arterial diseases have been relieved in a certain number of patients, temporarily during treatment, and some permanent relief of pain has been noted in a smaller number. The best results apparently have been obtained in individuals with mild ischemia, in those with ischemic neuritis, in acute arterial occlusion, and in instances of frostbite of moderate degree. The treatment has been disappointing in cases of thrombo-angiitis obliterans with gangrene. Contraindications to treatment are associated venous occlusion of any type and the presence of local infection and cellulitis. At present, it is difficult or impossible to predict results in a given case. An impartial evaluation of the intermittent pressure and suction treatment is that it has a certain place in the armamentarium but that it is by no means superior to certain other and certain simpler methods of therapy of vascular diseases and that it cannot be used routinely in all cases.

The Sanders Bed. — The most recent mechanical device used in the treatment of peripheral vascular disease is the Sanders oscillating bed. This bed is similar to a child's see-saw, or teeter board, the fulcrum of which is midway between the two ends. When one end rises the other sinks. Before treatment is begun, the bed is fixed in what is called a middle position. This position may be set at various angles from the horizontal. In use, the ends of the bed travel

through a total fixed arc of 70 degrees, half of which is described above and half below the position which the ends occupied when they were in the middle position. The foot and head of the bed can be raised on the base if desired and there is an additional hinged joint at the level of the knees so that the patient can be placed in various postures. The speed of the cycle can be adjusted at two, four, or eight minutes. For cases of peripheral vascular disease the treatment merely amounts to postural exercises carried on for long periods of time without effort on the part of the patient, and the physiologic effect is the alternate partial draining and filling of the arterial tree by gravity. It is necessary to adjust the speed and angle of rotation to the individual patient so that the period of blanching is as short as possible. There have been some reports of rather good results from continuous treatment of occlusive arterial disease of the legs, but the bed has not yet been used long enough or in a large enough series of cases to allow any conclusions as to its true value. Some patients tolerate the treatment better than others and some seem to obtain relief of pain and to sleep much better when they are on the bed. One advantage is that the treatment can be kept up for hours or days. According to our present experience it is probable that the bed is inferior to a number of other methods of therapy for vascular diseases and should be used only in conjunction with other procedures.

Summary

Physical agents have a definite place in the treatment of peripheral vascular diseases, especially of occlusive diseases of the arteries. They do not supplant medical and surgical procedures and usually give the best results when used in combination with them. In a few cases certain physical agents may be the most effective type of therapy. It is necessary to adapt any plan of treatment to the individual case and to vary it from time to time. There are definite contraindications to the use of certain types of physical agents in the treatment of vascular diseases.

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Discussion

Dr. Simon Benson (Chicago): Dr. Barker's classification of the development of peripheral diseases, that is, the primary local lesion, the subsequent chronic congestion, and the secondary lesion, is, to my knowledge, the most rational presented. As regards physical therapy the essayist doubts that it has much influence on the evolution and involution of the vascular lesions themselves. A lesion — its evolution and involution — is to me a metabolic process, and being such, it may be influenced by physical agencies. The real task before us is to find the

proper agency and also how to apply it. The application is as important as the agency itself, because the right agency, if misapplied, may prove to be a wrong one. In other words, in our discussions of physical therapy, we should always include the technic used, not in loose but in definite terms.

Dr. Barker quite appropriately stresses some possible misuses of physical therapy, particularly in cases of chronic ischemia, and similar conditions, involving skin and tissues vulnerable to mechanical, chemical and thermal stimulation. That is a very good point, and it can not be overemphasized. The author infers, however, that massage, for example, "has little or no value in the treatment of local ischemia or congestive diseases of the limbs." If that statement is based upon personal experience, we would suggest that the technic be changed. The effect of massage depends on what kind one gives. It behooves the physician to ascertain whether or not the masseur possesses the proper technic. Why should not "dosage" be as important in physical therapy as it is in drug therapy?

Even in such measures as pressure — vacuum therapy, which may be controlled quite accurately — the question of proper "dosage" is only vaguely considered. At present the aim seems to be to prescribe a similar dose in all cases, which would be right, no doubt, if all cases of vascular diseases were of the same kind and degree, and all patients reacted alike. But this is evidently not the case. As Dr. Barker said, treatments should be "individualized," a splendid advice which should be observed always.

Take the application of cold for illustration. Dr. Barker objects to the use of cold for one of several reasons; namely, that "it always depresses tissue metabolism." But the depressing effect of a cold application depends on several factors, including the intensity of the cold and the duration of the application. A brief cold douche, for example, is stimulating, not depressing! It increases the tissue metabolism. Prolonged cold will, of course, depress tissue metabolism, and it should not be applied unless such an effect is desired. These are fundamental factors in physical therapy, yet we all, much too often, fail to give them proper consideration.

Here we must add a word about contrast baths. From a scientific point of view, the term contrast bath can not mean much unless the temperatures and time factors are given. That is, how cold is it, and how hot is it — and how long is each application. A contrast bath of, say 108 and 60 degrees F. must differ in its effect from one of, say 104 and 75 degrees F. Until physicians become more particular in the precision of such treatments, there is little hope that we can come to any definite understanding as to the effect of such a common treatment as a contrast bath. As regards the recently revived and developed suction-pressure treatments, I have become convinced by considerable study that, in a large measure, success or failure of that treatment depends on the technic. The greatest problem to overcome appears to be the constricting influence of the cuff. There are now two general types of cuffs used — the elastic and semi-rigid. The elastic one has the advantage of fitting the limb quite easily, but there is no method of controlling the pressure it exerts on the limb. The semi-rigid cuff is more difficult to adjust to the contour of the leg, but its constricting influence on the leg is subject to considerable control and modification.

Dr. J. C. Elsom (Madison, Wis.): It is obviously impossible for any of us to reconstruct senile tissues, arteriosclerotic or otherwise, but we can at least give nature a helping hand toward the process of reconstruction. To my mind, this is the sole aim of physical therapy. I am quite sure the dictum of the biologist who tells us that function makes structure still holds, and all of the physical methods which have been mentioned by Dr. Barker serve toward increasing this natural function, whether it be heat, light, massage, hydrotherapy, postural exercises, electrical agencies, or what not. So if, by any of these means, we may increase function, especially circulatory and nutritional, we are pursuing, I am quite sure, legitimate methods. But physical therapy is so aptly equipped that it is only one member of a team in medical practice.

In recent years there has been an increasing amount of evidence as to the value of heat in the relief of pathologic conditions, especially of the blood vessels, extremities and in the vasoneuroses. Intermittent claudication is perhaps not so much a clinical entity in itself as it is a combination of sypmtoms observable in a variety of pathologic conditions. This symptom complex is caused by many forms of arterial lesions, arteriosclerosis and endoarteritis obliterans. So sometimes we think of patients who, when walking in cold weather, complain of pain in the foot or in the calf as having a condition attributed perhaps to rheumatism or may be to muscular strain, or something of that sort. Indeed, this pain may persist for months before the patient realizes that his toes and feet are cold and numb, and gradually perhaps ulcers and trophic changes may occur, and sometimes thrombosis. If diabetes is a complicating factor the situation is even more grave.

In the treatment of these vascular disturbances and disorders, we have heard that immersion of the extremities in water heated to a temperature not to exceed 105 degrees F. seems markedly beneficial in most cases. I think Dr. Barker perhaps did not mention the whirlpool bath which is so commonly in use and which in our clinic we find of extreme advantage. With the water rapidly revolving a kind of pressure is produced, and consequently we have a very mild massage through the introduction of air bubbles in the water, and sometimes saline solution. The pressure increases with the

density of the water, according to the amount of the saline constituents. In Raynaud's disease, which I want to mention very briefly, as I shall also the other things I want to talk about, we are confronted with a trophic neurosis. I mildly disagree with Dr. Barker on the treatment of this particular disorder. I believe heat is often beneficial. Of course, here again we must emphasize the fact that the heat must be mild, as has been so well brought out. I think in Raynaud's, as it has been sometimes described, we have three grades of intensity. One has been termed a local syncope, that is, an ischemia; the second is an asphyxia, that is, a dusky discoloration, red, from intense congestion, stasis, which usually follows the so-called syncope; and last of all, perhaps in extreme cases, gangrene.

In endoarteritis obliterans we have the production of new connective tissue which obliterates to some extend the lumen of the vessel. I liked very much the expression Dr. Barker used, "the production and maintenance of vasodilatation." After all, that is what we are trying to get, the production and maintenance of vasodilatation.

May I say one word or two about diathermy? Dr. Barker says it has a limited use as a vasodilating agent. Perhaps it has. Yet I want again to disagree mildly because he says the effects do not persist after it is discontinued. That has not been the experience of our clinic because we have found, especially with the modern methods of short wave treatment, that the effects do continue perhaps for an hour or more after the diathermy has been discontinued. In the short wave form of diathermy, if we give a mild heat perhaps rather long continued, I believe we get very much better results than if we have an intense degree of heat for a very short period. I think that holds during the application of heat generally. Sometimes, when we apply short wave diathermy, the patient complains that perhaps he doesn't feel very warm. That really makes no difference because the sensory nerves of the skin, of course, are what appreciate the heat, but the tissues deeper down are perhaps not so sensitive and the patient after all may be getting quite a sufficient amount of heat without feeling any abnormal sensation of heat on the skin itself. So if we regulate our temperature to a very mild degree, possibly one and one-half amperes with the short wave current, we are giving all that is necessary.

As to contrast baths and these other methods of what we might term circulatory gymnastics, I think we have agents that possibly may be well used in a great many different cases. After all, it is circulatory gymnastics. Gymnastics means exercise. Exercise means an increased blood supply, and the only thing under the heavens by which we can heal anything is by the flow of rich, red blood. If we can stimulate the flow of rich, red blood, we are putting nature in the best possible condition for the restoration of function.

Dr. N. W. Barker (closing): It is possible that some forms of physical therapy may have some effect on an inflammatory or degenerating lesion of a blood vessel. We must remember that such lesions usually lie deep in the tissue and are rather inaccessible. As far as I know, there is no definite experimental work to show that progression and regression of these lesions are influenced to any degree by physical therapy.

It has been my misfortune to see several cases of thrombo-angiitis obliterans and several of thrombophlebitis in which massage was followed by definite exacerbation of the disease and extension of thrombosis. Since any possible effect of massage in aiding circulation is transient, I am definitely opposed to its use when active disease of the blood vessels is present. In my clinical experience, patients who have had vascular disease have not felt that massage helped them.

With regard to the question of cold increasing the metabolism of tissues, I think that the situation is quite different if the tissues are markedly ischemic than it is if the tissues have a relatively normal blood supply. Many times ischemic tissues are surviving by a very narrow margin of safety and vasospasm, produced by even transient environmental cold, may be dangerous.

The value of passive vascular exercise is worthy of many hours of discussion and much has been written on the subject. I agree with Dr. Benson that we should be careful to individualize the treatment with this machine. As he brought out, the fitting of the cuff is very important and much difficulty has been encountered with ill-fitting cuffs.

I am very glad that Dr. Benson emphasized the importance of intermittent claudication as a symptom. Unfortunately, this diagnosis is often missed. It is always well to examine patients who complain of peculiar pain of the leg and foot for evidence of circulatory disease.

In Raynaud's disease, the fundamental disturbance is an intermittent vasospasm, which lasts a relatively short time (fifteen to twenty minutes). The phase of compensatory vasodilatation follows so rapidly that physical therapy is not necessary to combat these vasospastic episodes. I do not believe that physical therapy has any influence in preventing recurrence of the vasospasm.

The difficulty in using diathermy for patients who have vascular disease is usually its expense. If something permanent could be accomplished by diathermy, it might be worth while to try it, but in my experience its effects are transient. Therefore, I believe it is less practical than some of the other methods of physical therapy.

PHYSICAL THERAPY AND THE MANAGEMENT OF STIFF JOINTS *

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Orthopedic surgery, as it is defined today, has to do with the preservation and restoration of the functions of the skeletal system and its articulations and associated structures. It takes no stretch of the imagination to appreciate the close connection it has with physical therapy.

Twenty-five years ago I spent a few months in Liverpool with Sir Robert Jones, the outstanding orthopedic surgeon of his day. He was an accomplished surgeon in every sense of the word, but what interested me still more, was the treatment in his office, of stiff joints, backaches, sciatica, and neuralgias. I have recently reviewed the notes I made at that and at subsequent visits. His teachings have been of the greatest help to me during my years of practice, and although my remarks may be somewhat commonplace, they will bear repeating for they concern a generally neglected subject, the problem of the stiff joint. A few years before his death, Sir Robert Jones gave an excellent review of this subject in the William Mitchell Banks Lecture.*

Stiff Joints

When a patient presents himself because of a stiff joint, he should be carefully examined in a relaxed state, which is best obtained by having him lie down on a comfortable, rigid table or bed at a comfortable height for the examiner. It is essential that both patient and surgeon be at ease mentally and physically. After the patient's confidence is gained and he is relaxed, other positions may be assumed.

A stiff joint is caused, generally, by adhesions, and such adhesions may be extra-articular or intra-articular. Adhesions are pathologic bands caused by a serous or inflammatory exudate consequent to disease or trauma. At first soft and vascular, these bands later become fibrous and less vascular and lose their elasticity. The extra-articular variety may lie between the layers of the capsule of a joint or the ligaments, or may exist between the muscles and tendons that have to do with joint function. Restriction of motion caused by adhesions of this latter type is seen in myositis ossificans, Volkmann's ischemic paralysis, in the dense fibrous tissue of the palmar fascia, in Dupuytren's contracture of the palm, and also in deep scars and burns about joints. The intra-articular type may result from trauma, with or without infection. Adhesions may be the result of disease only.

If a stiff joint is caused by intra-articular or extra-articular adhesions, the logical treatment is to break them and thus restore motion. If adhesions are the result of trauma, then manipulation should be carried out actively and passively, but it must be done early. If adhesions are the result of infection, manipulation should not be carried out until all pain and inflammation have subsided, and it should be more cautiously carried out.

I have never forgotten Jones' teaching that if the movement of a joint is limited in all directions, the pathologic changes are due to arthritis, but that if movement is limited in only certain directions, arthritis is not the cause of such

* Read at the Mid-Western Sectional Meeting of the American Congress of Physical Therapy, The Mayo Clinic, Rochester, Minnesota, March 4, 1936.

* *British Medical Journal*, December 5, 1931.

limitation. This is more easily demonstrated in the spinal column, hip, wrist, and shoulder where movement in many directions is permitted. Jones qualified this simple guide somewhat because it does not apply when sepsis has involved extra-articular structures, or to fractures within joints or to joints temporarily stiffened by long fixation. In arthritis there is local heat and often periarticular thickening, the stiffness is usually progressive, and the shrinking of the muscles is greater than would result from lack of use alone. If the stiffness of a joint is due to adhesions only, there is no local heat, but local tenderness may be present, and the wastage of the muscles is not as marked.

Prevention

Too often the arthritic joint is allowed to become stiff when intelligent supervision would have prevented it. Jones taught that we should, "strangle an adhesion at its birth." The arthritic joint should be rested until pain and inflammation have subsided. When the painful stage is passed, the patient should be encouraged as early as possible to move his joint within the painless range. The surgeon should, with the patient relaxed (and if the patient is over-apprehensive this may be accomplished by giving him 1 grain [0.065 gm.] of codeine by mouth a half hour before), gently force the joint to the point of tolerance once a day. No "pumping" of the joint should ever be done. If a reaction follows which has not subsided by the following day, this procedure should not be repeated until the reaction has subsided. When stiffness is due to causes other than arthritis, movement should be carried out regularly so that the adhesions cannot mature into strong fibrous bands.

Injured joints from sprains or tears of ligaments should be afforded protection from strain, but early massage will prevent swelling and, by promptly removing exudates, leave muscles more nearly normal and tendons and their sheaths free of adhesive-forming exudates. Active movements of the joint may be carefully carried out under supervision to prevent strain of the injured ligaments. Pain is the warning signal.

Stiff Joints Following Fractures

The joint of a child or adolescent, although contiguous to a fracture, soon regains its motion after release following prolonged fixation, but this is not true of the joint of an elderly person, as is illustrated by the stiff knee which follows treatment of fracture of the hip. The knee joint is probably the most troublesome of all joints, and particularly so when the fracture involves the femoral shaft because hemorrhage into the muscular and fascial planes incident to the injury leads to adhesions. Early massage of the muscles and movement of the patella is desirable. Too often the knee is kept in a fixation cast or splint in full or hyperextension, a position that is certain to lead to stiffness of the joint. This is especially true of the fingers, elbow, and knee.

If there has existed a mild periarticular infection, or if the joint has been strained or held too long in extension, manipulation in stages should be done, if necessary under short anesthesia, breaking a few adhesions each time and putting the extremity in the recovered position for a day or so. The surgeon must be careful not to lose the movement gained, being certain that, each day, the joint is put through the full, new range of motion. Practically all soreness should disappear before the next manipulation is attempted.

Many times children are brought to a consultant because of a stiff elbow following a fracture. Roentgenograms show the fragments to be in satisfactory position. A story is told of daily visits to the surgeon's office, where the elbow was worked, somebody holding the arm (and the child) and the worried surgeon pulling and pushing the joint up and down and the child crying bitterly. Each day this was repeated, until all concerned — the surgeon, the parents, and the

child — were worn out. Such daily visits became a dreaded ordeal. By complimenting the doctor on the excellent result of his surgery and the parents on their earnest efforts, the consultant can have the atmosphere so cleared that the advice may be given to stop all treatments (much to the little patient's delight), and to turn the child back to play and to school for several weeks to see how things work out. Soon all are relieved; improvement is noted, and the elbow, much to everybody's surprise and relief, goes on to full restoration of function.

Stiffness Caused by Arthritis

The roentgenogram may be used as a diagnostic aid in all cases of joint stiffness whether arthritis is present or not. Destruction of joint surfaces and marked thinning of the articular cartilages indicate that any attempt to obtain more motion must be undertaken with great caution. One must be certain that the joint is free of infection, a fact that is by no means always easy to determine. If, on use, the joint does not swell much and the range of motion is not diminished, one may well conclude that the disease is not active. If a joint is more or less fixed at a certain angle and use only changes that angle to another fixed angle, one must take care not to manipulate it. When the range of motion is increasing one should trust to active motion; when it is not increasing, then and then only should passive movements be carried out, but not forcible manipulation. I can well remember in Jones' clinic seeing him order many knees put back in apparatus to give rest because, although flexion of the knee was increasing, there was loss in extension. When the knee had quieted down he would flex it passively to 10 or 20 degrees beyond its previous excursion and hold it there for twenty-four hours. Then, if full extension could be attained, he would be satisfied for a few days or a week, after which time he repeated the process.

Active and Passive Movements

Remarks about the institution of active and passive movements to a group of physiotherapists are no doubt unnecessary, but I venture to repeat certain admonitions of Sir Robert Jones. He insisted continually that active movements were the choice, and that passive movements were to be used only when improvement was at a standstill. Passive manipulation should be carried out only once, or at the most twice, a day. Jones said that any adhesion twenty-four hours old could be easily broken.

Jones repeatedly pointed out that forcible manipulation was a branch of surgery that had from time immemorial been neglected by our profession and one that had been left to the unqualified practitioner. His uncle, preceptor and teacher, H. O. Thomas, had in his day seen so much damage done by the manipulation of joints that should not have been manipulated, particularly tuberculous joints, that he swung to the left, as it were, and advocated rest in many cases in which movement would have been better. Sir Robert was astute enough to bring his practice back to the middle of the road, not abandoning Thomas' theory of physiologic rest, but selecting his cases carefully. The advent of the roentgenogram made this much easier.

On my first visit to Sir Robert Jones, twenty-five years ago, I found his Sunday morning free clinics most interesting and unusual for he did many startling things. The poor of Liverpool came literally by the hundreds to seek his aid. Babies had their club feet quickly twisted around and held in splints. The bow-legs of infants he corrected by grasping the limbs, and with his powerful but gentle hands breaking them and quickly applying a splint to hold them straight. Stiff shoulders were loosened up in an unusual manner. With the patient sitting on a stool, Sir Robert would stand behind him, and putting one hand on the patient's shoulder and his other arm under the affected arm, he would suddenly and forcibly abduct the shoulder. We could hear the adhe-

sions break. Not infrequently the patient would become faint from pain, but a drink of water and a whiff of salts would straighten him out. He would then be dismissed, after Sir Robert had made him put the arm up himself to demonstrate that he could do it, with the cheery admonition to "carry on." No anesthesia of any kind was used during these procedures. On returning home I tried some of these heroic measures myself, but I came to the conclusion that it took a man of Sir Robert's genius and a patient a little more cooperative than the American type to accomplish things in that manner.

As I recall those Sunday mornings with Jones, I marvel at the way he did it all with not the slightest touch of the dramatic. The manipulative procedures were quickly over and their simplicity was certainly appealing, for there were no hospital trappings, no superfluous assistants, and no recovering from anesthesia, with the attendant confusion, nausea, and so forth. I do not mean to give you the impression that surgical treatment for these poor people was neglected, for it was not. If the condition demanded operation, arrangements were made for the patient's admittance to one of the hospitals as soon as possible.

I wish to express my satisfaction at the progress made by physical therapy and its merited recognition. In conclusion I cannot do better than quote from Sir Robert Jones. This quotation is in reality the philosophy of life of a great man. As I have stated, he was continually decrying the fact that, owing to neglect by our profession, manipulative surgery had been left in the hands of the unqualified. He said in part: "Let there be no mistake; this has seriously undermined the public confidence, which has on occasions amounted to open hostility. If we honestly face the facts this attitude should cause us no surprise. No excuse will avail us when a stiff joint, which has been treated for many months by various surgeons and practitioners without effect, rapidly regains its mobility and function at the hands of an irregular practitioner. We should be self-critical, and ask why we missed such an opportunity ourselves. The problem is not solved by pointing out mistakes made by the unqualified—the question at issue is their success. Reputations are not made in any walk of life simply by failures. Failures are common to us all, and it is a far wiser and more dignified attitude on our part to improve our armamentarium than dwell upon the mistakes made by others."

Discussion

Dr. Robert E. Burns (Madison, Wis.): I think Dr. Henderson's completeness of presentation regarding the general principles of treatment leaves me with but little to add. I can only refer to isolated difficulties we encounter in various joints in the body. Considering the number of stiff joints we see, it would appear reasonable to conclude that they deserve more attention than they have received.

The best method of treating a stiff joint is to prevent it. This can be done by an appreciation of the difficulties to be encountered in lesions of the individual joints. It has been stated, for example, that any patient over fifty, with a broken wrist immobilized in palmar flexion and ulnar abduction for over three weeks will be a cripple. It consoles such a patient little to know that there has been anatomic replacement of fragments if the joint is left in disuse. Too often the fingers are splinted unnecessarily, active movement is neglected and permanent stiffness is the result. So far as stiffness is concerned, the elbow is one of the most difficult joints to deal with. Undue anxiety to restore motion often results in ill-advised manipulation, the results of which are often worse than the original condition. The shoulder is a source of great potential disability following injury or disease. This is especially true in the elderly patient. Abduction is the position of anatomic rest, because the muscles attached to the upper humerus are in equal relaxation in this position. However, we are not accustomed to think of a shoulder in abduction as being at rest. It is too far removed from the anatomic position. Hence the patient with a shoulder ailment is splinted with his arm at the side and the inevitable contracture follows.

Extension contracture of the quadriceps is one of the penalties attached to immobilization of the knee. It may be in part a necessary evil as, for example, in the treatment of fracture of the neck of the femur. Also, it frequently follows fracture of the shaft or suppuration adjacent to the knee. The quadriceps always takes up its slack and after im-

mobilization over contracture often results. It may be largely prevented by passive mobilization of the patella. This keeps the quadriceps pouch loose, a very important factor in the development of quadriceps contracture. It may appear that I have presented a rather gloomy picture of joint stiffness in the cases I have mentioned. Such is not necessarily the case. The patient with a fractured wrist should be instructed in the early active use of the fingers. Immobilization should not be retained too long. In the elbow, ischemic paralysis after fracture should be feared from the outset, diagnosed promptly and treated at once.

Forced passive manipulation should never be resorted to, especially until it is certain that there is no impending myositis ossificans. Here the x-ray gives us essential aid. Contracture of the shoulder may be prevented by a reversal of the conditions under which it is produced. Here, baking, massage and Codman's method of active exercises produce their most beneficial results. It is wrong to ask a patient with a shoulder lesion to exercise actively against gravity. Codman's exercises and sling suspension furnish an efficient substitute.

Dr. Henderson has mentioned active exercises as opposed to passive movements. Wherever possible, active movement is to be preferred. The patient often needs assistance, however, and I know of nothing better than the whirlpool bath and active exercises under hot water in the Hubbard tub. This method is very useful after trauma and has not been used as much as it merits. It is ideal for the stiff knee and hip following fracture of the neck of the femur. Such apparatus is not always available, however, and in such cases we should not forget the efficacy of sling suspension exercises, a method which can be used in any patient's home.

Manipulative surgery has not been practiced in this country to the extent it deserves. However, when it is used, the cases are often poorly chosen, the method bad, and the results worse. I refer especially to the abusive pulling on a knee, the site of an internal derangement due to a similunar cartilage. Sir Robert Jones has instructed us in a suitable procedure and if, after much maneuver, the cartilage is not reduced, surgery should be resorted to. Very great damage is often done to an elbow joint by the "pump handle" method to which Dr. Henderson has referred. Finally, in the manipulation of a shoulder, we should not lose sight of the possibility of fracture of the upper humerus in an atrophic bone, and that of a fat embolus.

Dr. Edward T. Evans (Minneapolis): Any remarks which I have to make are purely with reference to the orthopedic aspects of physical therapy. My several months at Sir Robert Jones' clinic impressed me as they did Dr. Henderson, except that at my later date Sir Robert and his associate, Mr. McMurray, had rather divorced themselves from Thomas' direct influence and were applying in its best sense our modern conception of manipulative surgery. Years ago, my father told me that no paper was worth presentation unless it brought forth a new truth, reiterated an old but forgotten truth, or provoked discussion. This paper presents, not a new truth, but an old one which needs reiteration, and it is certainly provocative of discussion.

I am struck with the fact that physical therapists are applying various methods to their specific fields. By this I mean that electrotherapy in its various forms may have its place, but not all the places, indications and uses the high-powered salesmen led us to believe. If one reads between the lines of Dr. Henderson's paper, one discovers that since time immemorial there has been a place for manipulative surgery which cannot be replaced but for which physical therapy is an adjunct. I know that at present we are all too often requested, even ordered, to treat ths rigid joints. We have often been baffled and thwarted in our results. Information we have received today may shorten convalescence for the patient and materially enhance our end results, always remembering that treatment must be "within the limits of comfort."

Apropos of arthritis, local rest is of paramount importance. This does not preclude careful use of heat, judiciously given stimulating massage, nor activity "within the limits of comfort." It does preclude strenuous active treatment. Reverting to "reading between the lines" of Dr. Henderson's paper, it is realized that no mention has been made of electrotherapy. This does not mean there are not specific fields for its use, but the more one treats the orthopedic cases the more one appreciates the value of local, moist heat, with massage and active exercise.

The physical therapist should be judged not by the apparatus he has but by his application of fundamental knowledge. It is regrettable that legal and technical phraseology has failed to specify his full scope, but it is also to be regretted that frequently physical therapy has been identified with electrotherapy rather than as physiological therapy in its fullest physiological sense.

Dr. M. S. Henderson (closing): I expected my discussors would point out a little more emphatically the dangers of manipulation. I would like to emphasize that as we bring younger men on and train them, and they become efficient and proficient in various operations, this type of surgery, manipulation under anesthesia, is one of the last things I will put in their hands. I think it takes more experience than any other procedure. I think I have had everything happen to me that can happen after manipulation, broken bones several times, and those bitter experiences are what makes one cautious. I feel it is my duty to emphasize that manipulation for stiff joints under anesthesia should be very carefully carried out.

PATHOLOGIC ASPECTS OF ARTHRITIS *

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Various studies on the pathology of arthritis have been presented from time to time, and have become fairly well recognized. Certain obvious facts have retarded any elaborate study of the pathology of arthritis. Many phases of arthritis cannot be approached surgically, and specimens can be obtained only in exceptional instances. Postmortem material, when obtained, often represents an end result rather than an active state of the disease. Most pathologists are not sufficiently interested to gather any postmortem material from joints, which may appear to offer anything new. The material removed from joints at operations in many instances is not studied.

What can be done to encourage a more widespread study of pathologic material? First, orthopedists and those interested in arthritis should make every effort to have all material removed surgically from joints, sectioned and examined. Secondly, there should be a closer spirit of coöperation between clinicians and pathologists. As I have intimated, postmortem material often is of little use as it does not reveal active stages of the disease, but anyone interested in obtaining specimens of various types of arthritis could obtain valuable material by attending necropsies.

Many conceptions of the pathology of arthritis are based on clinicians' observations plus the study of roentgenologic changes. While these are important, I feel that many such conceptions are erroneous. In many instances by the time the roentgenogram reveals characteristic changes, the disease has advanced to a stage where conservative therapeutic measures will be of no avail.

It seems to me that little is known about cartilage. The anatomic structure of hyaline cartilage is usually visualized. Its physiology, both normal and pathologic, is almost unknown. How it gets its nourishment has long been a subject for discussion. Some argue that the synovial fluid supplies the necessary nourishment, others maintain that the marginal regions are supplied by the circulus vasculosus of Hunter, while the central region is supplied by diffusion from the underlying bone marrow. Either or both of these conceptions may be correct, but the fact remains that one does not know enough about the physiology, the pathologic physiology and physiologic chemistry of hyaline cartilage to construct any sort of an hypothesis about its relation to diseases of joints. The more one studies the pathologic changes, the more one feels convinced of the importance of hyaline cartilage in the pathologic changes of this disease. Many of the changes can be demonstrated to center around the cartilage. Whether some fundamental chemical or other change in this substance is behind the picture cannot be stated in the light of our present knowledge.

Tuberculous Arthritis

The change in tuberculous arthritis is well known, because of the fact that for many years surgical treatment of this condition has offered the best results; hence, a large amount of pathologic material has accumulated, much of which has been studied. The pathologic changes may be described as follows:

* Read before the Mid-Western Sectional Meeting of the American Congress of Physical Therapy, Mayo Clinic, Rochester, Minnesota, March 4, 1936.

Synovial Membrane. — There is extensive formation of tubercles and occasionally there is some caseation. Variable amounts of fluid are formed.

Bone. — The bone is invaded by Mycobacterium tuberculosis, and tubercles form. Gradual destruction of trabeculae occurs, but there is little regeneration of bone.

Cartilage. — There is an overlying of varying amounts of synovial pannus which gradually destroys the superficial layers of cartilage. Subchondral granulations spread underneath the cartilage and ends of granulation tissue grow up into the cartilage and gradually destroy it.

Relation of Pathology to Treatment. — The importance of physical therapy in the light of these facts cannot be easily depicted. It is a well known fact that rest plus general measures cure tuberculosis. Except for heliotherapy and its various substitutes, physical therapeutic measures do not offer much help. Rollier has demonstrated this most conclusively. On the contrary, it must be admitted that the best of efforts to emulate Rollier's results have failed in this country. For the most part, ankylosing operations remain the best form of treatment.

Pyogenic Arthritis

Synovial Changes. — There is an early edema with exudation of fibrinous material; later, there is infiltration with polymorphonuclear leukocytes. Then organization commences, and the ultimate result is fibrosis of synovial membrane. Successive layers of exudation and organization may at times be demonstrated.

Bone. — In the early stages of pyogenic arthritis little change is demonstrable in the bones. In the more advanced lesions, the intertrabecular spaces may be filled with polymorphonuclear leukocytes. Sequestration is rare.

Cartilage. — Phemister's classic description of the changes produced by the reaction of cartilage to pus from pyogenic joints is well known. He demonstrated that cartilage may be destroyed in a few hours by the action of pus produced by pyogenic microörganisms. On the contrary, cartilage exposed to pus from tuberculous abscesses revealed very little change. In more severe pyogenic infections, the cartilage may be destroyed in from a few hours to a few days. The virulence of the organism has a great deal to do with the rapidity of this process. Once the cartilage has been destroyed, raw bone comes in contact with raw bone; hence, ankylosis frequently is an end result of pyogenic arthritis.

Relation of Pathology to Treatment. — The pathologic changes have one important bearing on the treatment of pyogenic arthritis. Ankylosis does not occur in many cases, and articular motion may be restored. Early movement should be encouraged after the more acute symptoms have subsided. On the other hand, the process often leaves the cartilage in a softened vulnerable state, in which it may be easily damaged by permitting weight-bearing at an early date, or by forcible passive movements.

The pathologic changes in *gonococcic arthritis* are the same as those in any other type of pyogenic arthritis. Various pyogenic microörganisms all produce the same type of reaction; the extent and rapidity of the inflammatory process depend largely on the virulence of the organism and on the patient's resistance.

Proliferative Arthritis

Synovial Membrane. — Proliferation of the synovial membrane is one of the outstanding features of this condition. As a direct extension of the synovial proliferation the synovial pannus extends over that portion of the articular surfaces, which are not in contact, and destroys them. Later, the surfaces which are in contact may be destroyed. A fibrinous exudate from the

synovial membrane is often seen in the joint. Various degrees of villous formation are seen. The most characteristic change in this type of synovial membrane is the focal collections of small round cells, which in some ways simulate the formation of tubercles. There has been considerable discussion from time to time regarding the exact nature of these collections. Most authors refer to them as perivascular inflammatory collections of cells. As a result of a study of sixty-three such synovial membranes, Deacon and I feel that we can definitely demonstrate that these collections are not perivascular, but that they are definite focal collections that are brought together by some specific cellular stimulus, the nature of which we do not know. These appear at some stage in nearly every case of proliferative arthritis. Their duration is not well known. At some stages, actual mitosis of the central cells may be seen. Whether they are seen only during the active stage of the disease and later disappear as the activity ceases is not certain. However, they must remain for a considerable time as they were seen in nearly all cases in which we performed synovectomy. Many of these operations were performed in a quiescent period of the arthritic process.

Besides the focal collections there may be varying degrees of villous proliferation. Some edema is usually present. A rather marked degree of vascularization is seen, but there is very little thickening of the walls of the blood vessels. The latter is not so marked as that seen in degenerative arthritis.

Bone. — The pathologic changes in bone are not so well known. The reasons for this are obvious. While one occasionally may operate on a joint which is the site of an active proliferative arthritis, one rarely obtains bone for study. I have seen a few cases in which, for one reason or another, bone was removed. The changes most noticeable are atrophy of trabeculae with some infiltration of the marrow spaces, and occasionally collections of cells. The marrow spaces closely simulate the focal collections found in the synovial membrane.

Cartilage. — The pathologic changes in the cartilage probably are of the greatest importance. These changes in many ways simulate those found in tuberculosis. There is a definite formation of synovial pannus which spreads and causes a gradual destruction of the cartilage by infiltration from above. At the same time a subchondral process takes place with gradual undermining of the cartilage. Thus, the process of destruction of the cartilage goes on. Ultimately, the cartilage is completely replaced by fibrous tissue or bone, and bony ankylosis may occur.

Relation of Pathology to Treatment. — It should be remembered that the synovial pannus grows over the portions of the joint which are not in contact, and that if motion can be preserved the probabilities are that prevention of the growth of this pannus may be accomplished to some extent. Muscular strength must be preserved, if possible, by exercises which do not involve weight-bearing. If the muscles are extensively atrophied, their restoration by active exercises without weight-bearing, should be attempted.

Degenerative Arthritis

Cartilage. — In this type of arthritis the fundamental change is one of degeneration of cartilage. Early fibrillation of the matrix of the hyaline cartilage is seen. With this go some changes in the arrangement of the cells of the deep layers of cartilage. Instead of the regular columnar arrangement, the cells become grouped irregularly; some cells are large and some are small. The cracks in the matrix become wider, and the surface of the cartilage becomes irregularly frayed out until it resembles a tattered flag. More and more irregularity develops in the deeper layers. The cartilage

becomes thinner and gradually disappears completely in the regions in which the changes are advanced. The formation of cartilage increases about the margins of the joint; the new cartilage is not typically hyaline in character, but consists of an irregular fibrocartilaginous mass.

Bone. — The early bony changes are not well known. In fact, all the changes of degenerative arthritis are very slow and insidious and it is rare that the earliest changes are seen. With the gradual destruction of the cartilage the subchondral trabeculations become thicker. This process goes on until a solid plate of bone of varying thickness forms. Eburnation, which so commonly is seen in the advanced hypertrophic or degenerative arthritis, takes place.

Synovial Membrane. — The characteristic change is a thickening of the synovial membrane with some villous proliferation. Microscopic examination reveals thickening of the membrane, increased fibrosis, and some thickening of the walls of the blood vessel.

From the standpoint of pathology, the changes seen in *traumatic arthritis* are identical with those seen in the degenerative type. Tramuatic arthritis represents the reaction of the articular structures to injury of varying degrees of severity, such as acute and repeated traumatisms which are represented by stresses and strains, seen in an old dislocated joint which has been reduced but left with some change in its shape. This produces a constant wear and tear on the articular surfaces. Many examples of traumatic arthritis could be cited, such as the changes seen in a knee joint which contains a torn semilunar cartilage, and which has become dislocated repeatedly for many months. If such a knee is explored and if the cartilage is removed, definite fibrillation of the cartilage on the articular surface will be found. Microscopic examination of such articular cartilage rarely is possible, but the changes are typical of traumatic arthritis.

Little can be offered by any measures to repair the damage done in a case of traumatic or degenerative arthritis. Symptomatic treatment, and particularly rest, are of utmost importance, that is, weight-bearing should be eliminated. Nature will repair many of these defects after a fashion. The repair at best is a poor substitute for the original cartilage. However, in many cases the joint will be, for all practical purposes, as good as ever. Some joints will be limited in their scope of activity. In the more severe types the affected joints are doomed to an existence of limited activity, or to an artificial ankylosis.

Loose Body Arthritis

Three types of this condition may be recognized. The first and most common is osteochondritis dissecans. This condition, which was described by König, in 1879, as a dissecting osteochondritis, as a rule affects adolescents or young adults. Many patients may come for treatment later in life, but a careful inquiry into their clinical history will usually reveal a long duration of symptoms. Many theories as to its causation have been propounded, but none have been substantiated. Certain facts must be remembered. First, the condition affects the articular surface, and, therefore, the epiphyseal, cancellous bone; second, in most cases the condition starts in adolescence or in the later stages of epiphyseal development; third, the lesions may be multiple, that is more than one joint may be effected; fourth, the condition may be seen in later stages of epiphyseal disturbances, such as osteochondritis deformans juvenilis. All of these facts indicate that the condition is dependent on an original defect in epiphyseal development.

The second type is synovial osteochondromatosis. This is manifested by a much more elaborate production of loose bodies. This condition now is

generally recognized as a formation of benign tumors or a metamorphosis of the synovial membrane. Many loose bodies are usually found. Some may be pedunculated; many have bone as well as cartilage in their substance. In a third type, which is less common than these, loose bodies are formed in joints which are the site of an hypertrophic arthritis. Such joints may have many hypertrophic spurs. If these are on the margins of the patella they may produce a catching sensation when the joint is moved. Some of these hypertrophic spurs may become separated and give rise to loose bodies in joints.

Relation of Pathology to Treatment. — The treatment of this condition is preeminently surgical. Much aid can be secured with physical therapy in the convalescent stages, particularly in prevention of the development of atrophy of muscles, and in the restoration of motion.

Atrophic Arthritis

There is a group of joints which may be described as the site of a post-traumatic painful atrophy. In these joints bony atrophy, as well as muscular atrophy, may be demonstrated. In one case I have been able to obtain a specimen of the articular tissues. A definite atrophic condition of the cartilage could be demonstrated. Various descriptions of this condition have been given from time to time. In spite of this, it often goes unrecognized. An atypical catching is often described when the knee is affected. This is the result of fringes of the capsular folds which are caught between the articular surfaces; the capsule is relaxed and redundant because of the atony of the quadriceps muscle.

Relation of Pathology to Treatment. — Therapy is of the utmost importance, and in many instances it is difficult. Various artificial measures will fail to restore normal physiology. What is most important is a gradually increasing program of active exercises on the part of the patient. Such a program must be supplemented by massage, and I believe that the administration of cod liver oil and calcium also is important. The patient's constant coöperation must be secured or the results will not be satisfactory.

ATROPHIC AND HYPERTROPHIC ARTHRITIS AND FIBROSITIS *

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Arthritis

There is still debate in the literature as to whether atrophic and hypertrophic arthritis are separate diseases. The opinion has been expressed that the two types of changes in the joints may be produced by the same type of infection, that the difference in bodily response depends on the resistance of the patients, on hypersensitivity, on age of tissues, or on some unknown factor. The majority of physicians interested in arthritis do not agree with this view because atrophic arthritis and hypertrophic arthritis differ clinically, the prognosis being entirely different, as also are the laboratory and pathologic findings.

* Submitted for publication, September 3, 1936.

Atrophic arthritis is usually associated with loss of weight, secondary anemia, rapid sedimentation rate of erythrocytes, atrophy of bone and muscle, low blood pressure, lowered cutaneous temperature, exhaustion, and when uncontrolled, progressive injury to and limitation of joints. The patients affected are usually between the ages of twenty and forty years. However, when it occurs among those who are in their fifties, sixties, or seventies, the symptoms and prognosis are the same as for younger individuals.

Hypertrophic arthritis is commonly associated with no loss of weight, no secondary anemia, but with normal or only slightly elevated sedimentation rate of erythrocytes, bony spurs, slight if any muscular atrophy, without decrease in blood pressure and with absence of marked alteration in cutaneous temperature. Although the microscopic changes of hypertrophic arthritis may start in the late twenties or thirties as Bauer and Bennett, and as Keefer and Myers have shown, symptoms do not ordinarily develop until the patients are in their forties, fifties or sixties. Ghormley has clearly demonstrated the differences in the pathologic changes.

Treatment

Cecil questioned fifteen colleagues in various parts of the country regarding the treatment they preferred for patients with atrophic arthritis. Replies indicated that rest, physical therapy, removal of foci, and change of climate were favored. A diet low in carbohydrates was advocated and streptococcal vaccines were used with moderate frequency. Only a few physicians expressed a preference for foreign protein therapy, transfusion of blood, drugs, intestinal hygiene and fever therapy.

Physical therapy is the oldest and one of the most important known methods of treatment for atrophic arthritis. It is valuable for its curative effect in many cases; however, many patients find physical therapy alone to be inadequate for the control of arthritis Its use is essential in all cases in order to maintain as much joint function as possible and to minimize atrophy of muscles and deformities of joints. I shall not consider the relative merits of either the various methods of producing heat, or the types of massage.

Removal of foci in patients who have atrophic arthritis is the procedure of first importance in the opinion of most physicians, but is regarded as useless by some or actually dangerous by others. Removal of foci early in the course of the disease may be of considerable help. In cases of arthritis of about five years' duration, removal of foci generally gives disappointing results, but even in this group a few may be helped.

The tonsils and teeth are commonly regarded as the most important sites of infection. The sinuses, uterine cervix and prostate gland are considered of equal importance by other physicians. The gallbladder and intestines may be occasional harbors of focal infection. Although the original site of infection may have been in the tonsils, the same type of streptococci that was cultured from them can often be cultured from the nasopharynx after tonsillectomy. Removal of foci of infection obviously does not remove all of the infection, but may be of sufficient help to alter the progress of the disease.

Vaccines. — Because of conflicting reports regarding the merits of various vaccines, it is impossible to determine their worth. Injections of autogenous or stock arthrotropic vaccines occasionally are followed by considerable improvement. Some clinicians believe that the amelioration is the result of increased immunity, others that it is attributable to desensitization, and still others that the psychogenic factor is of most importance. The injections

may be given subcutaneously, intramuscularly, or intravenously, preferably in doses sufficiently small not to cause a systemic reaction. To give vaccine therapy a thorough trial, it should be continued for three to six months or longer.

Typhoid vaccine has been regarded as disappointing for the cure of atrophic arthritis. However, when used in those who are difficult to treat effectively by a conservative regimen, intravenous injections of typhoid vaccine have been of help in controlling a flare-up.

In a recent review of the literature on fever therapy it was noted that less than 10 per cent of patients who have atrophic arthritis became free from symptoms. About 25 to 30 per cent of them so treated noticed some relief. In the treatment of selected cases of atrophic arthritis, fever therapy has its use in stopping the progress of the disease. Additional treatment is almost always necessary.

Colloidal Sulphur. — Results from the use of colloidal surphur for atrophic arthritis have been disappointing to many physicians. However, some good results have been reported. No conclusions on the worth of this substance can yet be formed.

Colloidal Gold. — Many European physicians are using colloidal gold with reported success, in the treatment of atrophic arthritis. Even after injections of small amounts of this preparation, severe symptoms of toxicity may be observed, such as severe dermatitis, hepatitis, leukopenia, albuminuria, hematuria and even uremia. The dangers of toxicity have retarded the employment of this substance in our country. The majority of physicians believe that its administration is not warranted until it is proved to be superior to other types of therapy. Its use in selected cases in which the patients can be frequently observed during the course of treatment, is perhaps justified.

Fibrositis

Fibrositis is often wrongly diagnosed as atrophic arthritis or chronic nervous exhaustion. An inflammatory reaction in fibrous tissue may occur in the presence of rheumatic fever, atrophic arthritis, senescent hypertrophic arthritis, gout, gonorrhea, influenza or septicemia. In these cases the reaction in the fibrous tissue is but part of the dominant disease. Treatment of the primary disease is of the utmost importance. In cases in which there is inflammation in fibrous tissue secondary to a primary disease, the condition should not be diagnosed as fibrositis if confusion is to be avoided. In cases in which the diagnosis is properly fibrositis, there is an inflammatory reaction in fibrous tissue without demonstrable involvement of joints, bones or heart.

In reports from certain arthritis clinics it is noted that from 20 to 55 per cent of the patients observed have fibrositis. The etiology is unknown, although acute respiratory infection, foci of infection, exposure to dampness and cold, over-exertion, and absorption of toxins are most often regarded as the causative or precipitating factors. Stockman stated that the patients have demonstrable inflammatory nodules in the fibrous tissue during the attacks of fibrositis. The nodules may later be absorbed, or the exudate may become organized and result in fibrous scar tissue. The old scarred nodules may be painless to palpation; the actively inflamed portions may be felt as tender nodules or regions; the indurated portions may be obscured by muscular spasm.

Fibrositis may affect fibrous tissue anywhere in the body. Depending on what tissues are involved, the resultant clinical symptoms may vary. However, the pathologic changes in the various sites are presumably identi-

cal. The anatomic sites most frequently affected are capsular fibrous tissue, intramuscular fibrous tissue, subcutaneous fibrous tissue, perineural fibrous tissue, bursae and tendons. In each attack one anatomic site may be affected, although most frequently several structures are involved. A history of previous attacks of fibrositis in different anatomic sites is frequently obtained. The onset may be acute, as in lumbago, the attacks may be recurrent, or the fibrositis may be chronic. During an acute attack of fibrositis there may be considerable pain, local tenderness of fibrous tissue and muscular spasm. In the less severe attacks the patients complain of stiffness and aching. Moderate exercise, application of heat or the taking of acetylsalicylic acid usually gives temporary relief. In spite of their discomfort they may continue to be very active, and in such cases fatigue and exhaustion may be prominent symptoms. The patients usually appear in good physical condition, there is no intra-articular hydrops, and no muscular atrophy, although slight thickening of the capsule of the joint may be present. Roentgenograms of the joints remain negative. The sedimentation rate stays at normal or is only slightly elevated. There is usually no loss of weight or significant anemia. Function of the joints generally returns to normal. Occasionally, fibrous contractures occur. The usually accepted treatment is physical therapy with firm massage for a long time, and removal of foci to prevent recurrences. Relief from undue exhaustion or fatigue is also of importance. The use of vaccines and thyroid extract, has been reported to be of help in some cases.

GASTROSCOPY *

Indications, Contraindications, Technic

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Among the chapters of medical triumphs in the battle against disease, the courageous and often brilliant investigation of the cavities of the body has yielded one after the other valuable information. The rectum and sigmoid, vagina and uterus, the urethra, bladder, ureters and kidney pelves, the nose, sinuses and eustachian tubes to the middle ear, the throat and bronchial tubes practically to the periphery of the lungs, the peritoneal and pleural cavities, have successively been explored; and now it is possible to traverse the esophagus and explore the stomach, catheterize the duodenum and investigate the characteristics of the bile.

While the stomach is far from being the last organ to have been investigated, its relative inaccessibility, the dangers connected with the traverse of the esophagus and the difficulties in developing adequate instruments have combined to make gastroscopy the youngest and perhaps the most difficult procedure of endoscopy. Gastroscopy has now advanced to the stage of safety and reliability, where it can and should become a routine in practically all patients with definite and persistent symptoms referable to the stomach. For this reason we urge the wider adoption of gastroscopy by dissemination of the facts with reference to the wide range of its applicability.

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 9, 1935.

Contraindications

The contraindications to gastroscopy are those connected with the passage of the esophagus. While the number of diseases of the esophagus is large the contraindications are few in number viz.

1. Extrinsic.
   a. Aortic aneurysm.
   b. Enlarged thymus or other tumor.
   c. Diseases of the spine interfering with mobility.
2. Intrinsic.
   a. Advanced organic disease.
   b. Extensive varicosities.
   c. Acute esophagitis (corrosive and necrotic).

It is to be understood that the contraindications named above, as well as those to be mentioned may be either absolute, or cause for extreme caution in procedure, or may even be the determining factor requiring it, as in the lodgment of a foreign body complicating any of these, if it prevents the swallowing of food. Acute esophagitis due to swallowing of caustics, the most frequent of which is probably lye, calls for delay until healing has followed the sloughing, to strengthen the weakened walls.

Enlarged thymus may preclude the use of the gastroscope, and at any rate should call for extreme caution to prevent dyspnea by compressing the trachea against it from behind. Arthritis and tuberculosis of the spine producing deforming curvatures or ankylosis may make the passing of an instrument impossible. Extremes of age are *per se* no contraindications. Jackson[1] reports successful operations on patients past 80, on the new born, and removing foreign bodies as early as ten day old infants.

Indications

Gastroscopy is indicated in every case of persistent or unexplained symptoms referable to the stomach. Janeway[2] as long ago as 1913 made an eloquent appeal for its routine adoption in the study of disease of the stomach.

Of special interest as indications may be mentioned:

1. Gastritis.
   A. Acute.
   B. Chronic.
      1. Without additional pathologic processes.
      2. Associated with:
         a. Ulcer (gastric or duodenal).
         b. Cancer.
         c. Postoperative conditions.
         d. Biliary disease.
         e. Pulmonary tuberculosis.
2. Gastric symptoms with negative x-rays.
3. Gastric neurosis.
4. Gastrointestinal hemorrhage (unexplained).
5. Peptic ulcer.
6. Differential diagnosis between ulcer and cancer.
7. Neoplasms.

Many cases with gastric symptoms with negative x-ray findings and so-called "gastric neurosis" may be proved by gastroscopy to be gastritis.

Benedict[3] reports twenty-two cases of seventy-five examinations showing

gastritis; ten associated with duodenal ulcer, two with gastric ulcer, three with carcinoma, two as a postoperative condition following resection, and five (nearly 20 per cent) gastritis without any other demonstrated lesion. In the last named the final diagnosis rested primarily on the gastroscopic findings.

Over 75 per cent of ulcers occur in the duodenum, or more than three times as many as in the stomach. Obviously, duodenal ulcers are not visible with the gastroscope. Offsetting this handicap, it should be remembered that the problem of malignancy concerns practically only the gastric ulcers, cancer complicating duodenal ulcers being virtually unknown. Also those ulcers which are partially duodenal, but also involve the stomach are classed by Walton[4] as duodenal, because they behave like duodenal ulcers in not becoming malignant.

The gastroscope renders valuable information in confirming the diagnosis, in ulcer, possibly aiding in localization, description, extent, and if biopsy is possible, in determining its character.

In benign tumors of the stomach x-rays usually facilitate a satisfactory diagnosis. These are not very common. However, it is estimated that 35 to 40 per cent of adenomatous polypi probably become malignant.[5,6] These may be shown with the gastroscope, and again an early operation may be invoked with the cure of a potential cancer.

Were justification for this procedure thought desirable, ample reason would be forthcoming in consideration of the subject of cancer alone. Hoffman[7] in an extensive cancer survey for the Prudential Life Insurance Company, in giving comprehensive statistics from various parts of the world shows that deaths from cancer of the stomach reach the alarming proportions of 38 to 52 per cent of all cancer fatalities. The stomach is thus the commonest seat of cancer and heads the list of deaths from this disease. Reports from all civilized countries show that it is steadily on the increase as a cause of death. In part this may be due to better diagnosis, especially with the valuable developments in the technic of x-ray, and in part to a larger number of individuals preserved to the cancer age. These do not explain however, all of the steadily increasing number of deaths from this disease.

Gastroscopy In Cancer

The fact that 90 per cent of cancer of the stomach is primary, and that surgery shows a disappointing low percentage of successful removals, are eloquent appeals for anything which will add to our ability to make an early diagnosis. Holman[8] states that in only 25 per cent of patients seen by him is resection to be considered, and that of these less than 25 per cent (6 per cent of all) can be classed as cured.

Cancer of the stomach manifests itself in three principal locations.

1. Carcinoma of the lesser curve, which represents the most important and most common group constitutes about 45 per cent. Sometimes the symptoms here are so insidious in their onset that the disease is entirely overlooked, while in others a less serious lesion is diagnosed and proper treatment is not undertaken until too late.
2. Carcinoma obstructing the pylorus (35 per cent).
3. Carcinoma of the cardia (20 per cent).

Carcinomas of the cardia, although the smallest group, constitute a very important one, since these tumors tend to grow at a slower pace, and many grow to be much larger and may even when they are of large size and present a seemingly hopeless outlook, be found amenable to successful resection, due to the fact that they tend to metastasize later than the others. Janeway[9] of the Memorial Hospital of New York, and one of the leading students of malignancy has said:

The late diagnosis of cancer of the stomach, particularly of the cardia, has long been a blot on the reputation of medicine. . . . . If gastroscopy in conjunction with x-rays is made a routine in cases in which the diagnosis of cancer is a *possibility*, a large proportion of cancers of the stomach will be found in a stage in which it is possible to do something. . . . . Of not less importance, perhaps, is the consolation that we will be discharging our obligations which we owe these patients.

The much discussed and controversial question of the relation of ulcer to cancer has received a great deal of consideration, with wide variations of opinions since it was first discussed by Cruveilhier as far back as 1839. Mansell-Moullin[10] in 1910 reported the positive history of ulcer in 60 per cent. Mayo, in a report by McCarthy of 216 cases found in 79 per cent a past history of ulceration. Later investigators have reduced this percentage, so that today a fairly true estimate seems to be somewhere about 20 per cent with previous gastric ulcers. While this is much lower than at one time believed, we feel that these ulcers should be kept under careful scrutiny, for if the location be such as to permit endoscopic study, much valuable information can be thus added in our fight against this condition, particularly if biopsies can be obtained.

Esophagitis

Another important condition to be listed under the complaints of gastric symptoms is esophagitis. Many symptoms are common to both, such as substernal pain, nausea and vomiting, hematemesis, and the like. Hence a brief discussion of it is of value for the purpose of differential diagnosis.

It may be classified as follows: —

Esophagitis.

1. Irritative.
   a. Mechanical.
   b. Thermal.
   c. Chemical (including tobacco and alcohol).
2. Specific.
   a. Syphilis.
   b. Tuberculosis.
   c. Actinomycosis.
3. Secondary, as a complication of
   a. Cardiospasm.
   b. Diverticula.
   c. Neoplasms.

To which probably should be added

4. Peptic esophagitis.

Winkelstein[11] reports a series of characteristic histories, which were chiefly in elderly people between 50 and 70, with chronicity with exacerbations and remissions resembling peptic ulcer. They manifested substernal pain, pyrosis, acid regurgitations, dysphagia, and hyperchlorhydria. Many are associated with, or give a preexisting history of peptic ulcer of the stomach or esophagus as reported by Jackson[12] and Friedenwald.[13] These cases show an irregular spasm of the lower third to one-half of the esophagus without dilatation above, and the esophagoscope shows inflamed, edematous, thickened mucosa with or without ulcer. There may be an exudate either in small patches or large plaques. Although the lumen is markedly narrowed, it can be completely traversed without difficulty to enter the cardia. Pain in these cases may be so severe as to be mistaken for angina pectoris. Moersch[14] states that they are promptly and definitely relieved by antacid and ulcer therapy. This condition is distinguished from cardiospasm, which is characterized by a typical roentgenogram of a

gastritis; ten associated with duodenal ulcer, two with gastric ulcer, three with carcinoma, two as a postoperative condition following resection, and five (nearly 20 per cent) gastritis without any other demonstrated lesion. In the last named the final diagnosis rested primarily on the gastroscopic findings.

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diffuse dilatation above a smooth lower end of the esophagus, and is not relieved by antacid and ulcer therapy.

Jackson[15] finds this condition frequently in cases of herniated stomach, and believes that little is heard of it because so few esophagoscopies are done in patients with gastric symptoms. He makes a plea that in every patient with unyielding symptoms esophagoscopy is indicated as giving diagnostic information additional to that of the x-ray.

Technic

There are three types of instruments used in gastroscopy:

1. Open tube.
2. Lens systems.
3. Combined open tube and lens system.

Each of these has its advantages and its limitations. The open tube is necessary for biopsy, is safest, but has a very limited field of observation confined to the cardiac portion of the stomach.

Of the lens systems the Wolf-Schindler[16] is the most efficient instrument. It gives a very clear view of the stomach but has the objection that it must be passed blindly, owing to the fact that the view is lateral. Hence the condition of the esophagus must be thoroughly evaluated before its use.

The third represents an instrument that has all the advantages of the open tube, giving preliminary visual information concerning the esophageal conditions, and permits the introduction within its lumen of a lens system. This has the advantage of requiring but one introduction through the esophagus, enlarging the field of vision over that of the open tube, and enabling the operator to obtain where possible a sometimes all important biopsy specimen, all by one operation.

The first condition is to secure for the patient a relaxed state. To obtain this the following procedures should be adopted:

1. Two hours before operation one capsule nembutal or sodium amytal is administered.
2. One hour before, a quarter grain of morphine and a second capsule of nembutal or sodium amytal are given.
3. One-half hour before, instill into pharynx 1 cc. of a 2 per cent solution of butyn with a curved cannula. This is swallowed, causing a slight algesia.
4. Fifteen minutes before, swab lateral wall of pharynx on both sides with 10 per cent cocaine by holding against the lateral wall for 10 or 15 seconds on either side in the region of the recurrent laryngeal nerve. Apply on closely wrapped cotton securely fastened to a Jackson curved cross-action forceps. This application should be made three times at intervals of 5 minutes.

Position of Patient

Posture is of utmost importance. As the position is changed with the advancing of the instrument, each must be controlled by a trained assistant to synchronize with the operator's movements of the instrument.

Everything being in readiness, the patient being thoroughly relaxed in the recumbent dorsal position, a gauze sponge is placed over the upper front teeth to protect them from injury. (If there is any bridge work or plates these should be removed before starting.) The neck and head should be raised forward and held in full extension.

The gastroscope is placed in the mouth in a vertical position, with the bevel toward the roof of the mouth, slipping it gently down behind the tongue. It should be passed into the right side of the throat, so as to enter the right

pyriform sinus. Thus the tip of the instrument passes posteriorly and laterally to the right arytenoid cartilage.

During the introduction the instrument rests against the ball of the left thumb behind, with the index finger encircling it in front. The middle and ring fingers are hooked over the upper front teeth to act as a support for the thumb, which keeps the instrument held forward, away from the teeth and the posterior wall. The fingers in this position also give the operator control of the position of the head. In this way the thumb acts as a fulcrum by which the right hand can pull gently backward, directing the tip forward to press against the soft yielding tissues in front. It is to be borne in mind that the esophagus rests on the vertebral column, therefore care must be exercised to keep the instrument from riding against the unyielding posterior wall, otherwise it is very easy to cut through the thin wall of the esophagus, resulting in mediastinitis and possibly death.

As the gastroscope slips into the pyriform sinus, the tissues fold together in front of its tip like a funnel. This constriction is due to the action of the inferior constrictor which holds the larynx rather firmly to the posterior pharyngeal wall, and the cricopharyngeus muscle, which guards the entrance to the esophagus. As the tip approaches this guardian of the esophagus, the gastroscope is gently placed against it and the patient is directed to swallow. This releases the sphincter and facilitates passage into the esophagus. If the lumen is not clearly visible, or the muscle persists in spasm, a small woven silk bougie may be passed and the tip advance over it.

At this stage there may be some accumulation of fluid, especially if there is any obstruction beyond. This should be quickly aspirated with a large sized tube connected to a vacuum bottle. Skill and promptness are essential in preventing regurgitation of fluid into the larynx and trachea.

Care must be used to see that the shoulders are throughout resting against the table to maintain the proper position. As the instrument advances into the thoracic esophagus, the head is gradually lowered and moved to the right until the gastroscope is brought to the horizontal position and is pointed in the direction of the anterior superior spine of the left ilium. The passage through the thoracic esophagus should be without resistance. At about 23 cm. from the front teeth if the direction of the instrument is exaggerated toward the left and anteriorly, the crossing of the aorta may be seen as a pulsation. If the direction is correct this may not be seen. At about 27 cm. the narrowing at the crossing in front of the left bronchus may be observed.

The next important landmark is where the esophagus passes through the diaphragm. This is aptly called by Jackson the diaphragmatic pinchcock. In the normal esophagus there should be no difficulty in passing through this sphincter into the stomach. It should be remembered that the lower third of the esophagus turns to the left and forward. For which reason this direction should be followed by pointing toward the left anterior superior spine of the ilium. Of particular importance is this position when contending with the folds of a dilated esophagus. If anywhere the lumen should not be plainly visible, a bougie will be of great assistance.

Several times during the introduction it may be necessary to aspirate fluid, as the field must be kept clean. Upon entering the stomach there is liable to be a sudden gush of fluid which must be anticipated and promptly aspirated. During the introduction of the gastroscope a careful inspection should be made of all parts of the esophagus and any abnormalities noted. As soon as the gastroscope enters the stomach, the light carrier is removed and the lens system with light for illuminating the stomach is put into place. This fits air-tight, permitting the stomach to be inflated, which should be done carefully under guidance of the operator's eye. No more air should be introduced than is required

to push the stomach away from the window and obtain a clear view. An occasional bulbful or two of air will keep the mucous membrane under clear observation. A good method to prevent overinflation is to have an assistant place a hand over the epigastrium.

Knowledge of the topography of the interior of the stomach is necessary for proper orientation. The rugae present formations characteristic of each location, which facilitates identification of one's position. By rotating the lens system and advancing or retracting to different levels and with change of the position of the tip by moving the head toward the left, the various regions of the stomach may be viewed. The gastric rugae, normal, edematous or inflamed, ulcerations and hemorrhagic areas can be clearly visualized, many of which frequently are not demonstrable by x-ray examination.

The whole procedure of introduction and inspection should be completed in 10 to 15 minutes. This operation is liable to be considered a formidable and fearsome ordeal, but while there is some discomfort due to the position of the patient, with proper skill and experience it should not be a painful procedure, and this assurance will do much to enlist the patient's confidence.

Conclusion

1. Gastroscopy is a recognized and valuable procedure.
2. Its contraindications are few.
3. Its indications cover every disease of the stomach, or symptoms referable thereto, though not necessarily every case of gastric disease.
4. Of particular advantage is its aid for the early diagnosis of cancer and precancerous lesions.
5. In important cases biopsy may be obtained for the establishment of a correct diagnosis.
6. Although a technical procedure requiring much skill and experience, it is a safe and efficient one.
7. Its routine adoption would greatly aid in successful treatment and in saving of life.

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(Concluded on page 596)

THE SIXTH INTERNATIONAL MEDICAL CONGRESS ON PHYSICAL MEDICINE *

RICHARD KOVACS, M.D.

NEW YORK

The Sixth International Medical Congress on Physical Medicine was held at London from May 12 to 16, 1936, in cooperation with the leading medical organizations and physicians of Great Britain. Among the latter were Lord Horder, the Hon. President, Lord Dawson of Penn, Sir Humphrey Rolleston, Sir Henry Gauvain, Sir Leonard Hill, Captain G. S. Elliston, M.P. His Royal Highness, the Duke of York, was honorary patron, and he attended a full morning's session. The President of the Congress was Sir Robert Stanton Woods, and the Secretary, Dr. Albert Eidinow. The other members of the Executive Committee of the British Section were Drs. E. Cumberbatch, Frank Howitt, James Mennell, and M. B. Ray.

The meetings of the Congress were held at the Great Central Hotel, the Royal Society of Medicine, the British Institute of Radiology and at Guy's Hospital. Visits and demonstrations were arranged at the British Red Cross Clinic for Treatment of Rheumatism, St. John Clinic and Institute of Physical Medicine, the Institute of Ray Therapy, the National Physical Laboratories, the Laboratories of Physiological Research of the University of London, the Army School of Physical Training, Aldershot. Receptions were given by Lord and Lady Dawson of Penn at the Royal College of Physicians, by H. M. Government at Lancaster House, and by the Public Health Committee of the Corporation of the City of London (Dinner), and visits were arranged at the end of the week to the Lord Mayor Treloar Hospital for Crippled Children at Alton, to Bath, and to Droitwich Spa.

The activity of the Congress was subdivided into six sections: (1) physical education, (2) kinesitherapy, (3) hydrotherapy and climatotherapy, (4) electrotherapy, (5) actinotherapy, and (6) radiotherapy and radium therapy. The official language was English, but the papers, which numbered nearly one hundred, were also in French and German. The approximate number of registrations was 250, among them over 50 from abroad. The countries actually represented were: Austria, Belgium, Bulgaria, Czechoslovakia, Egypt, France, Germany, Great Britain, Holland, Hungary, India, Norway, Poland, Portugal, Roumania, Switzerland, and the United States.

The presidential address of Lord Horder emphasized that among the criteria for carrying physical medicine forward, the first one was that the various methods and forms of technic employed in physical medicine should be brought and kept under scientific control. This desideratum could only be achieved if a close liaison was maintained between the physiotherapist and the physicist. A second criterion for success was a constant realization by the physical therapist that his approach must be primarily a clinical one. In proportion as he tended to isolate himself he lessened the benefits he was able to confer; for it was the patient and his reactions which were the final arbiters of results, whether in diagnosis or in treatment, and it was the clinician who could best judge these. A third criterion was a strict conformity with accepted pathology. The student and practitioner of physical medicine could make valuable contributions to pathology but he could not construct a pathology of his own. The fourth criterion was a liberal association of all workers in this particular field.

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York, September 7, 1936.

The Section on Physical Education was organized in an effort to enlarge the scope of physical medicine and increase public interest. It succeeded in both. The opening address of Lord Dawson of Penn stated that the physician with his knowledge of the structure and functions of the body should be associated with physical education, not in its day-to-day practice, but in its periodical survey. Medicine on its preventive side is educational, and the physician needs the attributes of the teacher. The movement towards a complete system of physical education is going apace in Great Britain and had been helped in no small measure by the recent investigation and subsequent report by a special committee of the British Medical Association.

The Section of Electrotherapy had the largest number of papers and was best attended. About 14 of these treated of short wave diathermy or fever therapy, and there was a symposium on their physical aspects. Other papers dealt with ionic therapy, with electrical muscle stimulation. In the Section on Kinesitherapy there was a symposium on treatment of industrial injuries and low backache. There were also actual demonstrations of manipulative movements at the massage department of Guy's Hospital. In the Section of Actinotherapy the toxic action following excessive exposure was presented and the relative benefits of sun, sea and air bathing discussed. In the Section of Hydrotherapy the combined treatment of rheumatic conditions, also hydraulic under-water massage and pool exercises were among the subjects presented. The Section of Radiotherapy had papers on treatment of diseases of the blood and neoplasms and of certain forms of chronic arthritis.

The teaching and organization of physical medicine were the subject of discussion of the only plenary meeting of all sections. Dr. Frank Howitt, of London, who presided, thought it unfortunate that the demand for physical treatment had come so forcibly from the lay public. This demand had outstripped the supply, and the general practitioner had been placed in the ignominious dilemma of either ordering electrical or ray treatment to be carried out by a qualified masseuse, or of installing apparatus himself without having learned even the rudimentary principles of the effects of such applications. Physical therapy should be brought into line with all other specialties as an integral part of clinical medicine. Dr. Kovács gave some account of the organization and teaching of physical therapy in the United States and also read in behalf of Mr. H. A. Carter a report of the work of the Council on Physical Therapy of the American Medical Association. These reports were well received and were held up as desirable ideals to attain in all other countries by subsequent speakers.

On the proposition of Professor Gunzburg, President of the International Committee, a series of resolutions were passed, the congress expressing its view that physical medicine should have a place equal to surgery and pharmacology in university teaching; that it should be a compulsory branch of teaching during at least two semesters and an independent subject of examination; that it should be given by an independent professor, who must be provided with the necessary material and personnel, and also with patients; and that there should be university institutes of physical therapy, organized in the form of a clinic or polyclinic, accessible for patients from other clinics, and open to members of the local medical profession and visiting physicians.

The attendance of the United States was larger in number than that of any other country and almost all of its members actively participated in the work of the Congress. Delegates of the U. S. Government were: Dr. Richard Kovács, New York; Dr. Wm. D. McFee, Boston; and Senior Surgeon H. A. Spencer, U. S. Public Health Service, London. Other members

were: Drs. L. V. Bouton, Amsterdam; Wm. J. Egan, Milwaukee; Anna Kubista, New York; H. Neifeld, Brooklyn; Walter M. Simpson, Dayton; and two technicians, Josephine L. Rathbone, Teachers College, Columbia University, New York; and Miss Gladys D. Paulitsch, of Montclair, New Jersey.

The papers contributed by the American group were, besides those already mentioned as given before the general meeting: in the Section on Electrotherapy, "Artificial Fever Therapy of Syphilis and Gonococcal Infections," by Dr. W. M. Simpson; "Electropyrexia," Dr. W. D. McFee; "Short Wave Therapy," by Dr. W. J. Egan; "Clinical Comparison Between Diathermy and Short Wave Diathermy," "Ionic Medication by Vasodilating Drugs," by Dr. Richard Kovács; and "The Effects of Electric Currents on Human Skeletal Muscle," by Dr. N. Neifeld; in the Section on Kinesitherapy, "Physical Treatment of Industrial Injuries," by Dr. R. Kovács and "Residual Neuro-Muscular Hypertension," by Miss Josephine L. Rathbone.

The British Section of the Congress worked tirelessly in organizing the Congress, in carrying through its activities and in extending most cordial hospitality to its members. Special mention must be made of the "Ladies' Committee" and the "Lady Helpers." In these the wives of the leading physicians acted most graciously not only as hostesses but also carried on the actual work of registration and general information in the Congress office.

The London Congress served as a valuable opportunity for men of distant countries to become better acquainted, and it promoted a clarification of many of the current problems in physical therapy by international cooperation. As a result there should be a better appreciation and more extended work in physical therapy in Great Britain, where the rank and file of the medical profession appears to be less interested in physical therapy than the American medical profession.

The attendance from the European Continent suffered by reason of the tense political situation. This accounted for a total absence of Italians and Russians. For the next meeting of the International Congress, to be held in 1939, invitations were received from the United States and Hungary. It was left in the hands of the International Committee of the Congress to take a referendum on the next meeting place. It is unlikely that the United States will be chosen on account of the distance and the expense involved.

WAVELENGTH AND THERAPEUTIC EFFECT *

HEINRICH F. WOLF, M.D.

NEW YORK

The introduction of short waves into the medical armamentarium has raised many interesting problems and heated discussions.

The first question was whether or not short waves have a specific action aside from their heating effect. The consensus of opinion, particularly in the United States, seems to indicate that a specific therapeutic action of the electrical field forces does not exist and that they exert their influence *in vitro* as well as in the living body by the production of heat only.

The second problem, which also has not as yet been settled, is the importance of wavelength. The literature on this subject has already assumed enormous proportions, but it may be said that the general opinion tends more and more to the conclusion that no specific effect is produced by any par-

* Accepted for publication, March, 1936.

ticular wavelength . This attitude is, of course, a logical sequence of the one mentioned above. If short waves have not specific action except the production of heat, we can not possibly assume that one wavelength has any other effect than another. I stress the therapeutic action as it is obvious from the point of view of physics that substances of different dielectric constants are heated to a different degree. In the living organism, however, such slight differences are equalized by the circulation.

As far as the physics is concerned there is undoubtedly also a difference as the longer wavelengths have a larger ohmic component and cannot be used with a large air space unless unusually great energies are used. It has been maintained by most authors that the field forces are more homogeneous if ultrashort waves are used with large air spacing. Lately Hasché has tried to show that such a homogeneity in the field does not exist. These facts, however, do not prove that the physiologic and the therapeutic effects of the various wavelengths differ.

The experimental work done under the auspices of the Council of Physical Therapy of the American Medical Association does in no way elucidate this question. The Council has established as its criterion the rule that only such an apparatus is acceptable which produces a certain temperature elevation in the body. This, however, is only a test of the output and has no relation to the wavelength. Provided the output is sufficiently powerful, apparatus of wavelengths between 3 and 26 meters produce any desired temperature elevation. The height of the temperature produced, however, has a definite relation to the therapeutic value only in gonococcic conditions. In fact it has been shown that high temperatures have a decidedly harmful effect in other subacute and acute local infections.

The only instance in the literature which could be accepted as evidence of a difference in therapeutic effects of various wavelengths is described by Liebesny. He mentions a case of actinomycosis which did not improve under 15 m. waves but was cured by 4 m. waves. In my opinion this report is not conclusive as we have no proof that the energy applied to the patient with the 15 m. wave was the same as when he received the 4 m. wave. This is the crucial point, but unfortunately we have no way at present of testing the energy expended locally. The methods used so far have been pronounced unreliable, whether the temperature is measured by thermocouples or metallic thermometer. To overcome this difficulty Paetzoldt has constructed a thermometer built of quartz and filled with benzol. Such an instrument is practically uninfluenced by the electric field.

But aside from these technical difficulties clinical experiences have to be weighed carefully, as it is generally known that one cannot draw definite and unquestionable conclusions as to the effect of treatments on different patients; one cannot even draw such conclusions on the same patient, unless we can be sure that the intensity of application was the same in each treatment.

The saying that we could cure all diseases if we could kill a guinea pig twice should be augmented to include the proviso that the condition of the guinea pig does not change between the two treatments.

Effect of Different Wavelengths

In order to arrive at a more satisfactory answer to the question of the effect of different wavelengths I decided to treat patients with an analogous condition in both hands at the same time with different wavelengths.

We frequently meet with arthritics who suffer from an involvement of both hands. Heberden's nodes are often bilateral. I found pathologic conditions of the hands with or without marked edema particularly suitable. They

readily respond to short wave treatments and we can immediately notice the change, manifested by a marked though generally temporary improvement in the motions of all the finger joints.

I used the following technic: Two large electrodes (5x8 inches) were placed side by side. Proper air space between the electrodes and the hands was provided. The amount of air spacing depends on the wavelength. The shorter the wave the larger the air spacing by felt or towels. While I generally place both hands on these two electrodes, in these experiments I used two different apparatus of different wavelengths, two electrodes for each hand. The patient was unaware that a different wavelength was used on each hand. The current was turned on and the intensity regulated in such a way that the patient had the same heat sensation in each hand. We may assume that we are using the same energy if we get the same heat effect. In this way I used the 6, 9.5, 22, and 24 m. wave, from both spark-gap and tube machines. It was interesting to observe that the patients showed exactly the same results in both hands, no matter what wavelength I used.

H. B. had Heberden's nodes on both hands. The motions of the fingers were slightly painful, the hands cannot be used properly, for instance in playing golf. The patient was treated by a 6 m. tube apparatus on the left hand and 9.5 and 22 m. spark-gap on the right. The improvement immediately after the treatment was marked and equal on both hands. The hand could be closed with ease after the first treatment.

H. W. had a so-called hypertrophic arthritis in both hands, particularly the left, some restriction of motion in the phalangeal joints particularly of the left fourth finger. Alternately the 6, 9.5, 22 and 24 m. wave apparatus were used on either hand. The improvement was immediate, although not permanent, regardless of the wavelength used.

C. B. had a rheumatoid arthritis, apparently due to an abscess in the edentulous lower jaw. The middle finger of each hand was swelled, the interphalangeal joint was enlarged and it was impossible to flex these fingers completely. Immediately after a treatment with the 6 m. wave on one hand and 9.5 m. on the other the patient could close each hand without difficulty.

H. C. had a generalized rheumatoid arthritis. Both hands showed the same type and intensity of edematous restriction of motion. Tonsils were removed, also some abscesses in the edentulous jaws. Though the general condition improved, the hands remained swelled and painful. Waves of 6, 9.5, 22, and 24 m. waves were used alternately and concomitantly on both hands and the immediate result was the same, regardless of the wavelength used. An interesting feature was the fact that the patient complained of a numb feeling in the left hand during the treatment, no matter what wavelength we applied to this hand.

N. J. suffered from a styloiditis at the process of both radii. Difficulties in supination. The 6 m. wave was used on one hand and 9.5 on the other, rotation was encouraged during the treatment. After 15 minutes both hands could be supinated without difficulty.

In reporting these experimental cases I do not wish to say that the pathologic condition was permanently cured. Such results depend on the removal or persistence of the etiologic factor. I only wish to point out that immediate, identical results were obtained regardless of wavelength, if the energy used was sufficient to bring about the same physiologic effect; namely, the same amount of heating of the involved tissues, as evidenced by the subjective sensation of the patient. Under the experimental conditions set forth this is not difficult to obtain, as it is easy to compare the heat sensations in the hands.

These experiments of course do not determine whether the various wavelengths would produce the same results in internal organs, unless we could show that the physiologic effect obtained, as manifested in heating the tissues, is identical.

Conclusions

Patients who were suffering from an analogous condition in both hands were treated with short waves of different wavelength on each hand in the

same session. Identical results were observed regardless of wavelength used.

From the experiments described we may conclude that the different wavelengths have no specific effect and that the difference in the therapeutic effect reported in the literature may have been due to the circumstance that the local intensity of the treatment was not the same each time.

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STUDY OF COLONIC ROENTGENOGRAMS

CHARLES J. DRUECK, M.D.

CHICAGO

Disturbed colonic function is associated with all stages of malignancy of the bowel, and many authorities consider it an etiologic factor of this disease.

Roentgenologic examination of the rectum proper is not essential, because given a suitable position the entire organ is within reach of the examining finger and may also be inspected by direct vision. But in some individuals proper sigmoidoscopy is impossible, and in order to enable one to differentiate organic obstructions of the gut from spasm or adhesions competent x-ray examination offers the only solution. The clinical evidence presented in pathologic conditions of the colon is frequently meager. The proctoscopic examination is necessarily limited to a small area of the large bowel. The fecal examination except in a few specific lesions is also insufficient and often misleading. The physical examination will always result in a high average of inaccuracy and incompleteness. Roentgenograms are of great value in revealing constrictions of the colon before typical symptoms of the late stage develop, and may be employed to advantage in selected cases. Their possibility of converting an advanced partial obstruction acutely into a complete stage must never be lost sight of. The clinician must always be present during the roentgenologist's examination to observe the progress of the barium meal or the clyster.

While the colon injection alone will usually reveal most of the abnormalities, a thorough understanding of the exact situation can be learned only by the combined method of frequent and careful observation of the ingested meal during its progress through the colon, this to be followed by the injection after a thorough preparation. By frequent observation of the barium meal, one is often given a hint of existing abnormal conditions. The possibility of multiple malignant foci in the bowel must be kept in mind.

The observer will note the motility, or lack of it, in the different portions of the colon; the size, shape and position, or varying positions of the viscus; signs of adhesions or obstructions; possible filling defects, or other lesions, as colitis, diverticulosis, and the like. With this information the observer is able to decide upon the special procedure to follow in the examination after the enema. Our routine method is to give the patient at least three cleansing enemas between seven and seven-thirty in the morning, then permit him to eat breakfast and to report at the roentgen-ray department between nine and ten o'clock. For the injection, an aluminum enema can is used, with the outlet in the bottom. A rubber bulb is placed about mid-way in the tube, the tubing leading from the can to the bulb being of large size, which, with the rubber bulb, will enable one to keep the barium from settling in and clogging the tube. The usual-sized glass rectal tube (well lubricated) is used, which the patient is required to insert himself. This precaution often saves the roentgenologist an unpleasant experience. The roentgenoscopic room is dimly lighted and if the examiner inserts

the tube, it will require additional light thus spoiling his eyes for the examination and even then he may injure the patient. If the patient inserts the tube he will not hurt himself, and he will be in a less nervous attitude, consequently in better condition to cooperate with the roentgenologist during the examination.

The vehicle used should be a mixture in which the barium is well suspended and free from lumps. Gum tragacanth has proved to be a most satisfactory medium in which to hold the barium in suspension. A least four ounces of barium sulphate should be used to a quart of solution and we have found it advisable after the mixture has been thoroughly triturated to strain it through a fine sieve.

With the enema container about two feet above the level of the table, the tube in place and with the patient lying comfortably on his back, the solution is allowed to flow. If the barium enema does not flow readily or at any time seems to stop, the flow can be easily started again by shutting off the tube and compressing the bulb.

Observation Following Enema

Observation should commence as soon as the enema begins to fill the rectum. Unless this is done a lesion low in the ampulla may be hidden by the filling of the healthy rectum above. In the normal ampulla the Houston's folds (two on the left side and one on the right) should be clearly seen. The normal rectum when distended with the enema should measure not over three inches in diameter and from five to six inches in length. The barium stream hesitates for a short time as it reaches the rectopelvic junction, then passes quickly through the pelvic loop and hesitates again at the ileopelvic junction. If the pelvic loop is free, it should rise to near the level of the interiliac line; if it is not free, an effort should be made to induce it to rise. Manipulation under the screen of this portion of the colon is difficult as it lies nearly under the pubic arch. To obviate this condition, the head of the roentgenoscopic table may be lowered, or the patient rotated to the right or left.

From the rectopelvic junction to the splenic flexure the passage of the barium is rapid. If this portion of the colon is spastic, its caliber is small, often no larger than a pencil, and the progress of the barium is correspondingly rapid. At times a localized spasticity involving but a few inches of the colon may be noted. This condition should be considered indicative of some inflammatory process such as diverticulitis.

An apparent delay is always noted at the flexures, especially the splenic but by rotating the patient to the left oblique position, or by separating the arms of the flexures with the hand under the screen, it will be noted that there is a wide loop extending from front to back and that under normal conditions there is no actual delay at this point.

After the barium column has rounded the splenic flexure, the patient will normally experience less difficulty in retaining the enema. Occasionally while the distal colon is being filled, there will be observed a mass peristalsis which will cause the patient some discomfort. The second apparent delay will be observed at the hepatic flexure, where a smaller backward loop exists. Careful observation should be made at this point by rotating the patient or mechanically separating the arms of the flexure, observing if there are any irregularities or evidence of adhesions, bearing in mind that one of the indirect signs of gall bladder lesion is a deflection upward and inward of the hepatic flexure by hepatic adhesions.

The ascending colon usually fills easily without any particular distress to the patient. Special care should be taken to round out the cecum, noting carefully its movability, its size and position. In many instances the cecum will be found to be very movable. Often it can be moved from without inward at least three inches; or upward from three to four inches.

Great stress should be placed upon the observation of the tip of the cecum, as many times it is found to be inverted, or tipped backward and upward by an adherent appendix, and valuable information may be obtained concerning the appendix, even though it cannot be visualized.

By giving utmost attention to every portion of the colon as the barium enema is administered, one or more of the various signs of carcinoma or other forms of tumor should be detected. Case notes six signs of carcinoma: (1) Exaggeration of colonic anti-peristalsis, giving the appearance of "peristaltic unrest" to the barium content above the site of the lesion, with arrest or hindrance in the onward progress of ingested barium; (2) arrest of noticeable hindrance in the ascent of the barium column when giving the barium enema; (3) coincidence of a palpable tumor with a point of hindrance to the barium meal or barium enema; (4) a filling defect in the shadow of the barium-filled colon. Frequently the filling defect is digitated, indicating a cauliflower growth. At times it may be annular so that one may diagnose an annular carcinoma; (5) the colon is often distended by gas, and gas collections are seen surging backward and forward, owing to the alterations of the peristalsis or anti-peristalsis; and (6) marked ileal stasis when the neoplasm involves the cecum, ileocecal valve, or the first part of the ascending colon.

Reinspection of Suspected Area

As soon as the barium is seen to pass through the ileocecal valve the enema should be discontinued and the tube removed. With the colon completely filled there is still an opportunity to reinspect any suspected area, and by changing the patient's position to right or left oblique, or by lowering the head and by use of the gloved hand or wooden spoon under the screen, a thorough check can be obtained of the entire colon. The suspected regions should then be roentgenographed while the patient is still on the table where the spoon or hand can be used to separate the loops of the colon, while under direct observation, bringing the suspected area into relief.

The patient should then be placed on a Bucky diaphragm and a large film made covering the entire abdomen. Occasionally stereoscopic films will be indicated. Additional smaller films of the suspected area may be advantageous with the patient placed in either the anterior, right oblique or left oblique position as the case may require, in order to demonstrate more clearly the particular abnormality. After this the patient should be allowed to evacuate the enema, and in cases where the previous roentgenoscopic examination is not entirely satisfactory he should be observed for the second time on the roentgenoscopic table. It is noticeably true that after the evacuation, additional information can be obtained in relation to points of obstruction, motility of the colon, or even filling defects which may be seen better after the larger part of the enema is emptied. When new information is obtained, additional roentgenograms should be made as a double check. It is sometimes advisable to make a later observation at twenty-four or forty-eight hours as this will be found helpful in demonstrating certain conditions, such as diverticulosis or a patent appendix.

Case suggests that occasionally the filling of the colon with air could be made useful for diagnostic purposes. This method has been advocated by various men and in some cases has without doubt proved helpful. In some instances we have used this method during the roentgenoscopic observation after the patient has evacuated the barium enema. The injection of air materially assists in the demonstration of the number and distribution of multiple diverticula of the colon that have been filled with the barium from the ingested meal. Stereoscopic films made at this time will often prove of particular interest.

It has been stated that there is at least twenty per cent error in the roentgen

(Concluded on page 594)

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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EDITORIALS

THE FIFTEENTH ANNUAL MEETING

The 1936 session of the American Congress of Physical Therapy, as compared with that of 1932, which also was held in New York City, has strikingly demonstrated the progress made by our national organization during that intervening period. From the very beginning one was impressed with the manifestation of deep interest in the scientific and economic problems affecting physical therapy in America. Soon after, no doubt was left in the minds of all who participated in the proceedings that the Congress has become accepted as one of the most important national organizations for the scientific exposition of Physical Medicine and as a representative body to safeguard the ethical medical profession against depredations by unqualified individuals. So manifold and extensive were the activities of the Congress during the session held this month, that it appears desirable to report them under the following separate groupings.

Place of Meeting. — All offices, exhibits, and meeting halls were housed on three floors of the world-famous Waldorf-Astoria. Apart from the luxurious and esthetic environment, the management of this hotel placed at the disposal of the Congress its largest assembly halls, one of them having a floor space of ten thousand square feet. In spite of this spaciousness it became necessary at some general sessions to increase the normal seating capacity by providing extra conveniences to accommodate the audiences.

Registration of either members or visitors was free of charge, which perhaps accounts why many failed to register their names and addresses. At that the registration exceeded the thousand mark. The total attendance is conservatively estimated to have been in excess of two thousand persons.

Publicity and Radio Addresses. — At this session a successful effort was made to control and provide both technical and popular publicity in the daily

press for wider dissemination. Selection of material was made with a view of arousing general interest in the nature and usefulness of physical therapeutic measures and thereby to benefit both the public and the medical profession In this effort the Press Committee was greatly assisted by Dr. Carl L. Levenson, of New York, whose untiring labors are gratefully appreciated.

Radio addresses were given under the auspices of the New York Academy of Medicine by Drs. A. R. Hollender, Disraeli Kobak, Richard Kovács, Frank H. Krusen, Norman E. Titus, and Grant E. Ward. These addresses were broadcast over the National Broadcasting Company's hook-up, and their value is evidenced by a large number of telegrams sent by physicians from all parts of the United States asking for copies of the addresses or repetitions over other broadcasting stations.

The Educational Conference initiated the week's program with an attendance that surpassed all expectations. Physical Therapy technicians were represented by a large group in order to become familiar with the import of their registration. While clinical training was ably discussed by several speakers, one was impressed with the fact that in New York and some other states the legal licensure and function of technicians has become a crucial problem. Miss Marion G. Smith, Registrar of the American Registry of Physical Therapy Technicians submitted a lucid and concise survey of the history, organization, aims and functions of the Registry and of its activities. This survey showed efforts by various authoritative bodies to control the present chaotic practice of physical therapy by technicians in improper competition with the regular medical profession. Mr. H. H. Horner, Assistant Commissioner of Education of the State of New York, critically analyzed the anomalous situation in his state and invited the cooperation of the medical profession in securing passage of a new law that would definitely prescribe the limitations placed upon the function of technicians. As pointed out by Dr. Anderson the situation is still not clarified, and the Congress is the logical body to bring about a normal situation in the interest of all concerned. In this the Registry sponsored by the Congress will play an active rôle.

The Business Meeting, which was held the first evening of the session, was noteworthy in some respects of general interest. The attendance was unusually large, possibly because a very interesting program was to follow the transaction of routine matters. Dr. John S. Coulter submitted a formal, audited report as treasurer of the Congress which revealed a sound financial basis. Dr. Titus made some well chosen remarks for the benefit of the organization. Calling attention to the literary success attained by Dr. Disraeli Kobak's editorial policy affecting the official monthly of the Congress, he nominated him as Editor-in-Chief of the ARCHIVES for five years. Mindful of the assistance that has been given during several years to the editor by Dr. Gustavus M. Blech, he nominated him as Associate Editor. In recognition of the long and valuable services rendered the Congress in an executive capacity, he nominated Dr. A. R. Hollender to be Managing Director of the Congress for a period of five years. These nominations were accepted by acclamation.

Dr. Disraeli Kobak followed with an extemporaneous report as editor of the ARCHIVES. He showed that the JOURNAL was now on a sound economic basis, but regarded as its principal asset the general recognition accorded the publication in America and all civilized countries as one of the outstanding organs devoted to scientific physical medicine and surgery. This was attained through a rigid editorial policy which was strictly adhered to, and to a great extent to the willingness of prominent authors here and abroad to contribute articles of scientific and practical worth. Dr. Kobak further made a plea that in future authors abstain from offering apologies for the employment of physical thera-

peutic measures, because physical therapy has long since passed its probationary period and has taken a place equal with all disciplines of scientific medicine. He also paid tribute to his newly elected associate, Dr. Gustavus M. Blech, for his valuable cooperation and his share in the preparation of foreign and surgical literature.

Special Reports. — Following the conclusion of business, Dr. Richard Kovács presented his illustrated report on the Sixth International Congress on Physical Medicine, which apppears elsewhere in this issue. An unusual and informative discourse was given by Dr. Victor E. Levine, who had but recently returned from the Arctic regions whither he had been ordered for an official investigation of the health problems of their inhabitants. His "travelogue" was richly illustrated by lantern slides, motion pictures and a large exhibit of objects manufactured by Eskimos.

The Annual Dinner differed from similar preceding functions in that no formal after-dinner speeches were held. President Bierman acted as toastmaster and limited himself to a few appropriate remarks. Dr. Kobak made a brief, humorous speech for the presentation of a gavel sent the retiring President, Dr. John Severy Hibben, by his admirers in his home state California. Dr. Hollender read the citations of the individuals honored by the Congress (vide infra) and Dr. Krusen announced the prizes awarded six scientific exhibitors. An interesting feature was an informative talk, illustrated by motion and talking pictures with musical accompaniment, by Commander George R. Pond, U. S. Naval Reserve, the noted naval aviator who, in 1934, flew from New York to Rome. He held out the prospect that aerial transportation to Europe would be a reality in the very near future. He also described naval activities with especial reference to submarine maneuvers and the measures taken by the naval authorities to safeguard the health of personnel engaged in preparation for undersea warfare.

The Exhibits were distributed in large halls on two floors, the scientific and technical material exceeding all expectations. Virtually every scientific exhibit was characterized by original research. The pathologic specimens, charts, illustrations, methods of treatment and organizations of physical therapy departments of large and small hospitals, too numerous for a detailed report, were of such excellence that the Jury of Awards had great difficulty in selecting the recipients of prizes. The technical exhibits, too, were not only very numerous but new in concept, all of which aroused considerable interest among critical investigators of newer and better equipment. Credit for the success of the program and of the exhibits of the session is due to a very great extent to Dr. Madge C. L. McGuinness and her co-workers in New York, whose discriminating efforts have borne fruit as one of the most eventful meetings of the Congress.

Acknowledgment. — One cannot conclude this report without expressing sincere appreciation to the American Medical Association for its scientific cooperation through its representatives, Dr. O. N. Anderson, of the Council on Medical Education and Hospitals, and Mr. Howard A. Carter, Secretary of the Council on Physical Therapy. The Congress also is indebted to the New York Committees who have effectively aided in the attainment of the fruitfulness of the fifteenth annual session.

AWARDS OF MERIT BY THE AMERICAN CONGRESS OF PHYSICAL THERAPY FOR THE YEAR 1936

As has been the custom for several years past, the Board of Governors of the Congress after due and careful consideration have bestowed this year's marks of appreciation of outstanding scientific labors by awarding the Gold Key of Merit to representatives of the United States and Europe.

Honorary membership in the Congress has been awarded to one French and three American physicians and associate membership has been awarded to two American representatives of allied sciences.

Their citations are as follows:

1. *Gold Key of Merit.*

Edwin Beer, distinguished son of New York, noted urologic surgeon, for his pioneering work in the intravesical destruction of tumors of the bladder by the high frequency current and in recognition of his highly scientific contributions to the literature of urologic surgery.

Sir Henry Gauvain, distinguished son of Great Britain, for his humanitarian and scientific care of crippled children by means of helio- and aerotherapy, and in recognition of his valuable contributions to the advancement of physical therapy.

Professor Stefan Jellinek, distinguished son of Austria, for his great humanitarian interest in the prevention and management of industrial electrical accidents and for his outstanding labors in the domain of electropathology.

Professor Joseph Plotnikow, distinguished son of Jugoslavia, pioneer in the scientific and industrial application of photochemistry, in recognition of his great service to science by the preparation of a monumental monograph on his special discipline.

2. *Honorary Membership.*

Eugene Landis, distinguished son of Pennsylvania, in recognition of his outstanding research in and scientific contributions to the science of physiology.

Jean Saidman, distinguished son of France, in recognition of his numerous original studies and valuable contributions to the science of electrophysiology and electrotherapy.

Charles Sheard, distinguished son of Minnesota, in recognition of his fruitful investigations and contributions in the domain of biophysics.

Arthur Steindler, distinguished son of Iowa, in recognition of his original research and literary contributions which have enriched the scientific basis of orthopedic surgery.

3. *Associate Membership.*

Howard A. Carter, distinguished son of Illinois, in recognition of his services rendered the cause of ethical physical therapy by his valuable labors as secretary of the Council on Physical Therapy of the American Medical Association.

Myron Schwarzschild, distinguished son of New York, in recognition of his indefatigable and fruitful labors in the domain of physics, which have proved of decided value to physical therapy.

The Jury of Awards for Scientific Exhibits announced the following prizes: Gold Medal to Dr. Mortimer N. Hyams, of New York; Silver Medal to Dr. Raphael Schillinger, of Brooklyn; Bronze Medal to Dr. Edward F. Hartung and Miss G. V. Ammermuller, of New York; Certificates of Honorable Mention to Dr. M. H. Cottle, of Chicago; Drs. George M. MacKee and Anthony Cipollaro, of New York; and to the New York Postgraduate Hospital, Vascular Disease Clinic.

ARTHRITIS

Arthritis up to recently has been one of the most crippling and baffling affections which the medical profession has been called upon to eradicate. The inadequacy of our therapeutic measures to ameliorate this protean disease has created situations the implications of which have reached deep into the fabric of our social, economic and even psychologic structure. This was in part due to the fact that the concept and as a corollary, the treatment of arthritis was reduced to perhaps one single etiologic factor. It will be recalled that the generic term "rheumatism" was not only born in antiquity but has also been maintained by popular acceptance to cover what is now recognized as varied groups of inflammatory and degenerative changes in the articular and soft tissues of the body. Naturally the therapy was empiric and no more specific in effect than the degree of knowledge of the day.

The past decades which have seen a renaissance of scientific medicine were also productive of an evolution if not complete revolution of the concept and therapeutic management of arthritis. The realization of its infectious, toxic and metabolic basis has paved the way to varied and rational remedial measures. Thus there was developed as an addition to pharmacal therapy a system of treatment theoretically aimed at combating the underlying causes. This especially applies to sera, vaccines and similar biologicals. At the same time search was continued for galenicals capable of desensitizing the tissues to the antigenic effects of infection. This applies to preparations that have been subject to scientific tests under the most rigid control. Organized medicine in America is to be felicitated that under the ever watchful aegis of the American Medical Association optimistic reports based on superficial observations are placed under proper check until their value is definitely determined. This is exemplified by the recent publicity of an alleged new cure with a certain benzoate compound emanating from a meeting of the American Chemical Society which was promptly challenged by the authorities of our national association. With the gradual recognition that the primary source of infection often was located remote from the affected area, surgical procedures assumed an important rôle in the removal of infectious foci. For the pathologic changes of the disease proper general therapeutic management had to be augmented by suitable corrective measures.

Apart from the recognition that arthritis runs a more favorable course under suitable climatic conditions, it was early appreciated that the proper application of such physical agents as heat, massage, corrective exercises and to a progressive extent also electrical modalities, not only shortened the period of disability but also enhanced the results of classic therapeutic intervention. It is seen therefore, that physical therapy has become more than a mere adjunct, and that it is part and parcel of internal and operative medicine. This is fully supported by the authors[1-2-3] of the symposium on arthritis appearing in this issue. The contributors to this discussion are authoritative in their special fields and their evaluation of physical therapy in the management of arthritis may well be accepted as an index of the general recognition

that the disease is complex in character, and cannot therefore be fully controlled by any one single measure. It has been found essential to adapt a composite therapy to meet individual indications. In the overwhelming majority of instances, however, physical measures will be the keystone in itself capable not only of relieving distressing symptoms but of hastening the restoration of function, which in turn will overcome the social, economic and even psychologic disabilities incident to arthritis.

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(Continued from page 588)

findings, but if the colon receives a thorough and painstaking examination, repeating the test in all obscure instances of suspected disease, or in cases of doubt, this high percentage of error can be greatly reduced. In the case of complete obstruction of the colon, the successful injection depends on the degree of distention and the location. If it be proximal to the hepatic flexure, the enema will usually reach this point. If the distention is extreme there may be sufficient pressure upon the sigmoid to cause a secondary obstruction, complete or partial. This phenomenon is confusing and has frequently led to erroneous interpretation.

Conclusion

Roentgenograms are but shadow films and show only well developed abnormalities in the contour of the bowel. They do not demonstrate minor degrees of obstruction. If the clinical history suggests obstruction it is safer to give the contrast enema first and studied before a contrast meal is given.

The fluoroscopic study often suggests abnormal deviation of form or function which was not previously explained, and which may not show in the final roentgenogram. The clinician should always stand at the roentgenologist's elbow during the fluoroscopic study that he may the better visualize what the final report portrays.

58 E. Washington St.

TECHNICIANS' EXAMINATION

The American Registry of Physical Therapy Technicians announces an examination to be held in Los Angeles, Calif., Wednesday, October 21, 1936, at 9 A. M., in the Los Angeles County Medical Building, 1925 Wilshire Boulevard, under the supervision of Dr. John Severy Hibben. Further details can be found in this issue on page 604.

THE STUDENT'S LIBRARY

ELEMENTS DE MEDECINE ET DE PHYSIOTHERAPY. By Dr. *I. Gunzburg*, Professor of Physical Therapy at the University of Brussels. Pp. 174 with 70 illustrations. Brussels: Rene Henriquez, 1936.

This volume is a summary of the lectures given to medical students at the University of Brussels, where lectures on physical therapy are compulsory. The lectures are divided into two parts. Part one deals with the basis of physical medicine and includes chapters on the evolution of physical medicine; the various forms of energy and their effect on the organism and on the reaction of the organism. Part two discusses the methods of physical therapy and contains chapters on all forms of exercise, heat and cold, hydrotherapy, electrical energy, radiant energy, the physiotherapeutic prescription, and the indications of physical therapy in various conditions. The book is well illustrated and contains a number of comprehensive tables; its presentation is concise and its style lucid. These features and the long experience of its author as an active practitioner in physical therapy make it one of the best contributions in French of recent years.

AN INTRODUCTION TO SURGERY. By *Rutherford Morison*, M.D., F.R.C.S. Edin. F.R.C.S. Eng., M.A., D.C.L., LL.D. Emeritus Professor of Surgery, Durham University, and *Charles F. M. Saint*, C.B.E., M.D., F.R.C.S., F.R.A.C.S., Professor of Surgery, Cape Town University, South Africa. Third Edition. Cloth. Price, $5. Pp. 367. Baltimore: William Wood and Company, 1935.

According to the authors the object of this book is to aid the student in thinking out for himself the problems presented to him in the wards and in the text-books. "The achievement of this object is attempted through the consideration of *general principles* and their application, by which it is realized that all the important pathological subjects to be studied (many of which, to the reader of ordinary text-books, would appear to be isolated entities) are part of an all-embracing whole." There are 22 chapters covering all the important subjects from shock to indications for operation. The plan of the book is such that the student at once obtains a comprehensive picture of the subjects discussed. Principles are stressed for "in teaching surgery, the essential factor for success lies in the establishment of general principles, their constant, often forceful, repetition, and their regular illustration by the cases which present themselves for examination." The outline of treatment is especially noteworthy, brief yet covering all the essentials. The chapters on gangrene, syphilis, tuberculosis and malignant disease are clear and concise and give the student an understanding of the problems without unnecessary details. The absence of padding is probably one of the outstanding attributes of this work which can be studied with benefit by students and practitioners alike. The charts and illustrations have been well prepared and selected. While large texts on surgery have a definite place in the reference library of every surgeon, and while the student must of necessity familiarize himself with technic and other details of this vast subject, those who desire especially an introductory knowledge of surgical principles and their application will find this work to be a valuable contribution.

ROSE AND CARLESS MANUAL OF SURGERY. Fourteenth edition revised by *Cecil P. G. Wakeley*, D.Sc. Lond., F.R.C.S. Eng., F.R.S. Edin., Surgeon, King's College Hospital, etc., and *John B. Hunter*, M.C.M. Chir. Cantab., F.R.C.S. Eng., Surgeon, King's College Hospital, etc. American (Fourteenth) edition edited by *W. T. Coughlin*, B.S. M.D., F.A.C.S., Professor of Surgery, St. Louis University School of Medicine; Surgeon-in-Chief, St. Mary's Group of Hospitals, St. Louis, Mo. Cloth. Price, $9. Pp. 1408 with index. Baltimore: William Wood and Company, 1933.

This edition has been especially revised and rearranged to meet American needs. The editors believe that it presents the present status of surgery more thoroughly than any other text-book intended for the use of students and general practitioners. Comprehensive in scope and detailed in descriptive material and technic, this work is especially of value for the student who today is required to leave the medical school with a broader and more thorough knowledge than formerly. Yet the practitioner, too, will find here a welcome addition to his library, for every subject in surgery is sufficiently discussed to serve for adequate reference. Certain changes and omissions in this edition are explained by the fact that the British and American curricula are not the same. Therefore in this, the American edition, it was thought desirable not to include matter which, though suitable and necessary to the British curriculum was superfluous to American requirements. "There has been much complaint in this country of a lack of correlation between clinical and pre-clinical years. This text-book has harkened to the call, and copious reference to, and rehearsal of, the anatomy, physiology, pathology, and bacteriology involved in each condition is the rule. The text is intended to emphasize for the student the principles and science of surgery rather than its practice and art. The last, we feel, should be built upon a proper knowledge and appreciation of the former. All this has been done in order that the student may have a thinking knowledge of the etiology, pathology, diagnosis and treatment of the most common surgical conditions. The reviewer's familiarity with this book began when he was a student. He has pleasingly observed in every revision improvements

and changes which have gained for the work the most favorable comment. The recent revision embodies all that one could demand in a scientific literary contribution on so vast a subject as surgery.

Delafield and Prudden's TEXT-BOOK OF PATHOLOGY. Revised by *Francis Carter Wood*, M.D., Director of the Pathological Department, St. Luke's Hospital, New York; Director of the Institute of Cancer Research, Columbia University, New York. Sixteenth edition. With 22 full-page plates and 839 illustrations in the text in black and in colors. Cloth. Price, $10. Pp. 1406. Baltimore: William Wood & Company, 1936.

The first edition of this work was printed in 1885. The fact that it has now passed through sixteen editions speaks for its popularity and the high value with which it is held by the profession generally. The outstanding positions of the original authors and their authority which they lent to the first writing is still manifest in this recent contribution although times and conditions have compelled certain changes. The frank statement in the preface that this is not an easy book to read is indeed commendable, for "it was not written to help the student practice medicine except insofar as it taught the fundamentals upon which medicine rests." The work is full of information on pathology and is suitable for the student who is seeking a grounding in the subject as well as for the practitioner whose requirements are only an occasional reference. Extensive changes will be found in the chapter on the Nervous System to which Dr. Edwin M. Deery has ably lent his assistance to the editor. Certain other chapters have been more or less revised, especially those on the Muscles, Bones and Joints. New material has been inserted wherever it seemed necessary and many of the older references discarded and replaced by others which cover the subject more fully or are more accessible to the student. To say that this is an outstanding work in pathology is only to add to the many complementary statements which every reviewer has made with each succeeding edition. No medical library is complete without this representative volume which is destined to be maintained by future editions because of its solid foundation.

NEUROLOGICAL SURGERY. By *Loyal Davis*, M. S., M. D., Ph. D., D. Sc. (Hon.), Professor of Surgery and Chairman of the Division of Surgery, Northwestern University Medical School, Chicago. Cloth. Price $6.00. Pp. 429. Illustrated with 172 engravings and 2 plates. Philadelphia: Lea and Febiger, 1936.

This book has been written primarily for the general practitioner and makes no pretense at presenting an exhaustive treatise upon each subject considered. The author states that his purpose has been to give to the practitioner of medicine easily assimilable facts which will aid him in offering his patient accurate and sound advice. This purpose has been well acomplished in the clear and precise exposition of the volume. There are chapters devoted to neurologic diagnosis; cranio-cerebral injuries; intracranial tumors and abscesses; osteomyelitis; cysts; primary and metastatic tumors of the skull; surgical lesions of the cranial nerves; spinal cord injuries; tumors of the spinal cord; injuries of the peripheral nerves; pain; surgery of the autonomic nervous system, surgical treatment of epileptiform seizures; cervical rib; syringomyeliae and traumatic arteriovenous aneurysm; hydrocephalus and spina bifida, and arachnoiditis. This list of subjects also indicates the value of this volume to physicians interested in physical therapy. Since physiotherapists are constantly treating pain, the chapters on pain should be read with degrees because it is a summary of the latest work on the pathways for the conduction of painful impulses and the methods employed for their surgical relief. There are also valuable sections on the use of physical therapy in the after care of spinal cord injuries, pointing out the use of massage, active and passive movements, underwater exercises, electrotherapy, the use of splints, muscle re-education and Fränkel's exercises. Another chapter particularly of value to those interested in physical therapy is the one on injuries to peripheral nerves. This book can be recommended to every physician.

(*Continued from page 580*)

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INTERNATIONAL ABSTRACTS

Artificial Fever as a Therapeutic Agent. Howard P. Doub.

Radiol. **25**:360 (Sept.) 1935.

The mortality associated with the use of malaria and the inherent difficulties with its safe usage has stimulated the search for other means of producing fever. Although injection of foreign proteins, vaccines and inoculation also cause an elevation of body temperature, these methods are objectionable because the temperature increase is uncertain and in some instances the fever has proved to be uncontrollable. The next logical step then was the production of fever by physical methods which could be easily controlled. Among these methods which have been used successfully are hot baths, diathermy, radiothermy, inductothermy, radiant light, and air-conditioned cabinets. Hot baths are likely to prove very debilitating unless the treatment time is quite short. With the use of diathermy the technical difficulties necessary to prevent skin burns made it a difficult method to use. Radiothermy has been used very successfully but the apparatus is somewhat complicated to operate and requires special care of the patient for rapid removal of the perspiration. Inductothermy is being used with success by many workers. Radiant light cabinets employing either infrared generators or carbon-filament lamps are cheap to build but are somewhat slower in temperature elevation. Air-conditioned chambers have made their appearance in the past few years and have proven very successful. The temperature of the patient is at all times controlled within close limits and the patient is as comfortable as it is possible to be under conditions of artificial fever.

The Use of Copper Ionization in the Treatment of Chronic Stenosis of the Lachrymal Duct. H. L. Hilgartner, Jr., and H. L. Hilgartner, Sr.

Am. J. Ophthal. **18**:454 (Jan.) 1935.

The patient, a doctor 68 years old, had been troubled for years with tearing in the left eye. He had had numerous treatments in the past with probings and irrigations, that gave only temporary relief. A new procedure was tried. A copper wire, the same size as a No. 3 Theobald probe, was passed through the lachrymal canal into the nose. A galvanic current of 4 milliamperes was then turned on. This was continued for twenty minutes. The current was supplied by nine dry cells with the negative pole connected to the copper wire, the positive pole being the indifferent electrode. The patient was only slightly uncomfortable during the treatment but experienced a severe reaction afterwards causing headache and pain for eight hours. On the following day the canal was irrigated with 2 per cent boric acid solution. The irrigating fluid passed freely into the nose.

The patient was again seen four days later at which time another irrigation was done, the fluid passing freely into the nose. The tearing had ceased entirely, and no discomfort was felt. There has been no return of symptoms and a No. 3 Theobald probe passed easily into the nose.

Preoperative Preparation of the Conjunctival Sac by Ultraviolet Rays. Frank W. Law.

Proc. Royal Soc. Med. **28**:192 (Dec.) 1934.

The apparatus used is the modified general phototherapy mercury-vapour lamp. It consists essentially of a lamp mounted on a movable stand in front of a hemispherical housing, over the aperture of which is fixed a flat aluminum disc, pierced in the center by a director tube. The patient's head is secured in the usual form of chin and head rest, and the lids are everted and held so as to completely cover the cornea. The routine adopted is to give six doses of five minutes each at two-day intervals, irradiation being carried out at a distance of about twelve inches; the number of doses is increased if necessary. It is quite as satisfactory to use the concentrated beam of the local phototherapy apparatus, with a suitably adjusted aperture. The conclusions drawn from this study are as follows: Ultraviolet irradiation is successful in nearly every case in rendering the eye bacteriologically safe for operation, even when the other methods fail. The pathogenic organisms appear to be more susceptible to the rays than the non-pathogenic, as evidenced by the infrequency of a resultant sterile culture. Some results suggest that the pathogenic organisms are only temporarily attenuated or inhibited, but that when this has been achieved operation may be safely undertaken. It is inadvisable to combine with this treatment the use of antiseptic lotions as the eye appears to be intolerant of such vigorous measures.

Leukocytosis Produced by Artificial Fever. P. Cohen and S. L. Warren.

J. Clin. Invest., **14**:423 (July) 1935.

To determine the changes occurring in the number of blood cells during artificial fever treatments, in which the patient's temperature was elevated and maintained at a constant level for a definite period by radiant energy, Cohen and Warren observed ten patients during a total of eleven treatments. There were seven treatments for gonococcic infection; one patient in this group was suffering also from latent syphilis and chronic infectious arthritis. The diagnoses in the remaining four cases were syphilis of the central

nervous system, chronic infectious arthritis, brain tumor and carcinomatosis. All observations of temperature during treatment were made by means of a resistance thermometer placed in the rectum of the patient. In practically every case the red blood cell count, hemoglobin, white blood cell count and differential count, including the Schilling hemogram made from coverslip blood smears stained with Wright's stain, were determined before treatment and every hour, starting when the temperature had reached the desired height and was being maintained at a constant level. These determinations were continued for several hours after the termination of the fever. The blood studies were then followed at intervals until the patient was discharged from the hospital. The counts were made from blood taken from the ear. A leukocytosis was found in every case. The maximal change and the onset, duration and extent of this change, in relation to the period of fever, varied from patient to patient. A relative and absolute increase of polymorphonuclear leukocytes was observed during or immediately following the febrile period. There was a substantial relative and absolute increase in immature polymorphonuclear leukocytes in six of the eleven cases. There was a relative and absolute decrease in lymphocytes in all cases. There was a slight rise in red blood cell count and hemoglobin during or immediately following the period of fever. Immature red blood cells were found in a single case, which also exhibited the greatest increase (20 per cent) in hemoglobin during a fever of 41.6 C. (106.9 F.) for twenty-one hours. These observations suggest a mobilization into the circulation of available and nearly mature cells of the myeloid and erythrocytic series as a result of the fever, while the cells of the lymphoid series decrease during the period. — [J. A. M. A. **105**:630 (Aug. 20) 1935.]

Hyperpyrexia in Treatment of Bronchial Asthma. K. Phillips and S. Shikany.

Southern M. J. **28**:801 (Sept.) 1935.

The value of hyperpyrexia in fifty cases of bronchial asthma is here presented. Practically all other therapeutic factors were eliminated. Clinical, biochemical and laboratory studies were carried out on all patients in order to determine the physiologic and biochemical changes associated with the treatment. Attention has been called to the clinical and laboratory data which indicate a lowered general metabolism in asthma. Improvement followed fever treatments and the clinical results indicate that 82 per cent received definite benefit. Biochemical and laboratory studies, however, indicate that more than 40 per cent of these were possibly only temporarily relieved. At present, after an observation period of six months, 32 per cent seem to have obtained lasting relief. The author believes that ten treatments should be the minimum of a course. It would appear that from twelve to fifteen are possibly still better, but apparently there is no improvement beyond this number. Two treatments a week are preferable. Temperatures maintained above 105 rectally have no advantage over those ranging from 102 to 105 F. Temperatures sustained for four hours produce results comparable to those extending over longer periods. — [J. A. M. A. **105**:1469 (Nov. 2) 1935.]

Surgical Aspects of the Treatment of Carcinoma of the Tongue. Edwin M. Livingston and Hyman Lieber.

Am. J. Surg. 30 (n. s.); **2**:234 (Nov.) 1935.

Leukoplakia before the advent of cancer is curable. It is variously estimated that from 50 to 75 per cent of lingual neoplasms could be prevented by the vigorous elimination of precancerous conditions. Small patches of leukoplakia which do not promptly respond to the removal of local irritation or those which show papillary overgrowth or fissure formation are excised with the scalpel. The incision extends 0.5 cm. beyond the limits of the lesion and is carried through the mucous membrane and submucosa. The muscle is not incised. The wound is closed with interrupted sutures. If no tissue is desired for microscopical study, such patches may be destroyed by the actual cautery or by electrodesiccation. Warts, ulcers, fissures and other premalignant lesions are variously treated by scalpel excision, electrocoagulation, fulguration, desiccation, endothermic removal or cautery destruction in a manner entirely analogous to the simple but effective methods employed for the destruction of similar abnormalities located upon the skin.

Thromboangiitis Obliterans (Buerger's Disease). George E. Brown.

Northwest Med. **34**:463 (Dec.) 1935.

Thromboangiitis obliterans affects men in the active, useful period of their lives. Failure to diagnose this condition and to institute conservative protective measures may result in the loss of one or more extremities. The diagnosis and appreciation of the sequelae of obstructive diseases of the arteries of the extremities are as crucial as is the diagnosis of appendicitis before the development of an abscess. Simple clinical procedure suffice for the diagnosis of diseases of the peripheral arteries. More accurate procedures are useful in determining the effects of therapy and in studying the progression or regression of the disease.

The Influence of the Heat Regulatory Mechanism of Raynaud's Disease. Herman E. Pearse, Jr.

Am. Heart J. **10**:1003 (Dec.) 1935.

The influence of body heat regulation was observed in cases of Raynaud's disease. It was found that: (1) with the hands kept warm, cooling the body will cause an attack of vasospasm; (2) warming the body will relieve an attack; (3) warming the body will not prevent an attack if the hands are exposed to cold; and (4)

the warming effect of food was inadequate to influence the vasospasm.

It is concluded that body heat regulation may have influence on the vasospasm of Raynaud's disease. This constitutes further evidence that normal forms of stimulation may give rise to an exaggerated vascular response. It suggests that a local abnormality causes this excessive spastic reaction from several factors.

Shock-Proof Fulgurating Urethroscope. Seymour F. Wilhelm.

Am. J. Surg. 29:152 (July) 1935.

A shock-proof fulgurating urethroscope has been devised to produce a simple anterior urethroscope for fulguration with unipolar or bipolar current. Since the bakelite sheath itself acts as an insulator, it is safe to use a thin bare wire electrode which does not appreciably obstruct the urethroscopic view. This fact, in addition to the improvement in the light system, will, I trust, afford better visualization of the anterior urethra, as well as safety for fulguration.

Verruca Senilis and Keratoma Senile. Hamilton Montgomery.

Minnesota Med. 18:11:735 (Nov.) 1935.

Verruca senilis usually develops in the later decades of life as multiple lesions. These vary greatly in size and occur chiefly on the trunk in the so-called seborrheic areas, although at times they appear in large numbers on the face. Verruca senilis must be regarded as a benign dermatosis, probably a delayed epithelial nevus, and need be removed only for cosmetic purposes or when located in areas subject to trauma or irritation. As the lesions do not extend below the level of the epidermis, they may be removed by fulguration or cautery as well as by excision. They do not respond well to radiotherapy because of the marked degree of differentiation of the individual cells.

Keratoma senile also occurs in elderly individuals and the lesions are found chiefly on the exposed surfaces of the body, especially among persons who have a sandy complexion and who are frequently exposed to the elements (sailors' skin).

They should be destroyed by fulguration, surgery, or excision, with the realization that the lesion may extend deeply beneath the epidermis and is not "stuck on" as is the lesion of verruca senilis. Because lesions of keratoma senile histologically frequently simulate the picture of Bowen's disease, which picture is also frequently present in early epithelioma from roentgen rays, treatment with roentgen rays of radium is contraindicated.

Transurethral Resection of the Malignant Prostate. Arthur Jacobs.

British J. Urol. 7:321 (Dec.) 1935.

During the past three years, the author resected fifteen out of nineteen cases of proved malignancy. The technic has been identical with that employed in benign hypertrophy. Preliminary cystoscopic or cysto-urethroscopic examination is routinely made, and the usual renal functional tests are carried out. A period of preoperative drainage, either by the indwelling urethral catheter, or by the suprapubic route, is the rule, the choice of method depending principally on the ascertained degree of renal impairment. It has been noted that bleeding resulting from resecting the malignant prostate is almost invariably slighter than that encountered when dealing with the benign type. In only one case was it necessary to use the coagulating electrode to control a bleeding point during operation, and in no instance has there been any trouble from postoperative hemorrhage.

From analysis of the fourteen cases who survived operation, twelve were successfully relieved of their obstructive symptoms. Of the two remaining cases, one required to have a suprapubic tube inserted in spite of the resection, and the other continued to have suprapubic leakage from a previous cystotomy wound even after two resections.

It is of interest to compare the duration of life of these patients with four other cases of prostatic carcinoma dealt with in the period under review. Three of these had suprapubic cystotomies only: one lived seventeen months, another five months, and the third fifteen days. The fourth case, who had no appreciable obstruction, was treated by radium inserted into the prostate through a perineal exposure. He survived for one year. The author therefore concludes that most patients suffering from carcinoma of the prostate can be relieved of their obstructive symptoms by a transurethral resection. The wearing of a permanent suprapubic apparatus is thereby obviated. As the disease progresses, the obstruction may recur. In the majority of cases, however, if sufficient tissue is removed to permit of satisfactory emptying of the bladder, death will intervene before a repetition of the resection becomes necessary.

Treatment of a Series of Cases of So-Called Carcinoid Tumors of the Bronchi by Diathermy: A Report of Ten cases. John Devereux Kernan.

Ann. Otol., Rhin. and Laryng. 44:1166 (Dec.) 1935.

It is very important that carcinoid tumors should be properly differentiated from true carcinomas, for even now competent pathologists report them as carcinomas, and on the basis of that diagnosis, a pneumonectomy is proposed.

With increasing experience it has been possible to obtain better results in the destruction of these tumors by diathermy. The original applicator used by the author was one improvised from a suction tube through which was led a long piece of tonsil snare wire. It was insulated by drawing over it a piece of rubber tubing. This could be passed through the bronchoscope and the end plunged with more or less accuracy

into the growth. Once in place, the wire was touched with an electrode leading from the diathermy machine, thus completing the circuit. This improvised instrument prevented any accurate placement of the wire, and prevented observation of the effects of the current on the growth. It was necessary to guess when sufficient current had been applied, and often its removal and replacement several times during the course of one treatment was called for.

The perfected instrument allows accurate placement of the tip and observation during the whole course of application of the current. The degree of the destruction of the growth may be seen and the current stopped once the operator judges the procedure has been carried as far as is safe. The tip takes the form of a thick bead, such as is used for the front sight of a rifle. It was found that a thin blade could not be seen sufficiently well. Also, the tip should be long enough to reach well into the lumen of the bronchus, which permits it to be plunged deeply into the growth. The perfection of this instrument has made possible much better results, more quickly obtained.

Medical Progress — Progress in Laryngology. LeRoy A. Schall.

New England J. M. **213**:574 (Sept. 19) 1935.

Ionization of the nasal mucous membrane has been given a new impetus by the work of Warwick and the enthusiastic attitude of the manufacturers of his electrical apparatus. Theoretically it is based upon the fact that the metallic solution placed in contact with the nasal mucous membrane, results in the precipitation of the proteins of the superficial cells. The method has been tried by Tobey who states that it has not been tried in a sufficient number of cases, nor has sufficient time elapsed to judge the relief adequately, which may be but temporary, given 85.6 per cent of his patients.

Whether the effect of ionization is anything more than a cauterization of the nasal mucous membrane is questionable. It remained for Palmer to have the courage of his convictions and treat a group of thirty patients with vasomotor rhinitis by a local application of concentrated phenol. The immediate effect of this treatment was exactly that which was obtained by the ionization instrument of Warwick, in that the mucous membrane showed a greyish, white discoloration followed by edema and obstruction with hypersecretion. Palmer had excellent cooperation from his patients, as they voluntarily permitted biopsies to be taken. The microscopic examination revealed that there was an increase in the connective tissue of the tunica propria with a diminution of the edema and vascularity. Of thirty cases treated by Palmer, twenty-four or 80 per cent showed definite improvement and twelve were free from symptoms for periods of from three to nine months.

McMahon approaches the subject of ionization from the pathologic point of view, by determining its effect on the nasal mucous membrane of dogs. He found that ionization is followed by a desquamation of the superficial epithelial cells, by an increased fibrosis of the connective tissue and by multiple abscess formation deep in the stroma. There was also a polymorphonuclear leukocytosis and an extravasation of red blood cells free in the tunica propria.

Fenton bluntly states that "ionization as such does not do anything more than damage the mucosal tissues of the sinuses."

Heliotherapy.

Survey J. A. M. A. **105**:1873 (Dec. 7) 1935.

Facilities for heliotherapy are quite uniformly present in the sanatorium group. Most of the institutions have made convenient arrangement for sun therapy on porches, on roof solariums or in sun pens. As regards artificial heliotherapy, there is a considerable variation in equipment. Many of the larger sanatoriums, especially those which also conduct a preventorium service, have large and well equipped heliotherapy departments for treatment en masse. In others, portable lamps may suffice.

It appears that in the use of heliotherapy the tuberculosis institutions adhere fairly closely to the methods and indications now generally accepted. A few, however, employ heliotherapy as a routine procedure for practically all patients regardless of the type, stage or activity of the disease. Of the 602 institutions that replied to a questionnaire, 440 reported facilities for artificial heliotherapy and a total of 1,589,720 treatments; 1,114,709 for adults, 320,704 for children, and 154,307 not classified.

Changes In Electrical Resistance of Nerve During Block by Cold and by Heat. Irvin F. Hummon, Jr., and T. E. Boyd.

Am. J. Physiol. **114**:85 (Dec. 1) 1935.

Bahrmann (1932) reported that when frog nerves are locally cooled, the failure of impulse conduction is either accompanied or immediately followed by a sharp rise of electrical resistance, in a typical instance from 98,000 to 344,000 ohms. An increase of this order was invariably associated with block, so that some necessary connection between the two phenomena might be inferred.

The three- to five-fold increase of electrical resistance, reported to be associated with cold block in frog nerve, is found to apply only to nerves frozen after supercooling to an average temperature of —6.0 degrees C. A freezing block can be induced in normal frog nerves at —1.0 to —2.0 degrees, with a resistance increase of less than 100 per cent. The non-freezing cold block is not associated with any gross break in the temperature-resistance curve. This is also true of heat block, as previously reported by Bremer and Titeca. Injury, such as is involved in careful dissection of the sheath, renders the nerve locally more susceptible to cold. This effect is reversible in Ringer's solution.

EDUCATIONAL STANDARDS FOR PHYSICAL THERAPY TECHNICIANS *

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Until after the World War education was piecemeal in the various branches of physical therapy, and organized training was practically nonexistent.

The war proved the stimulus for the development of education in physical therapy. The Army Medical Corps had hastily trained hundreds of medical officers and aides for rehabilitation and reconstruction work. So satisfactory were the results obtained by these workers that departments were established in all army hospitals, and regular training for physiotherapy aides was provided at Walter Reed General Hospital in Washington.

Physical therapy was coming into its rightful place in relation to other specialties. The rapid increase in facilities for physical therapy in all the larger hospitals and the resulting demand for adequately trained technicians gave rise to other schools and soon a number of universities and colleges established courses.

The American Physiotherapy Association

The American Physiotherapy Association was organized in 1920 by a group of women technicians trained during the war. To this group must be given credit for the first efforts made toward the improvement of education for technicians. From the beginning, this association considered standards for schools. In 1924, Dr. John S. Coulter suggested in a paper read before the association that educational standards be prepared. The next year, after the first requirements were published, the Secretary of the Council on Medical Education and Hospitals requested from the association a list of acceptable schools. He was supplied a list of four schools accepted as upholding the standards of the association. The Committee on Education and Publicity of the American Physiotherapy Association assumed duties in February, 1927, and published its first report in June of the same year. However, it was not until October, 1928, that its first published list of approved schools appeared in the *Physiotherapy Review*.

Realizing the need for future guidance by the members of the medical profession specializing in physical therapy, the executive committee of the American Physiotherapy Association sought aid from the Council on Physical Therapy of the American Medical Association. They requested that this Council act as the final authority in the approval of schools of physical therapy. The Council voted favorably on this petition and subsequently adopted, with some changes, the educational requirements already set up by the American Physiotherapy Association. The new standard was published in *The Journal of the American Medical Association*, February 8, 1930.

Neither the Council on Physical Therapy nor the American Physiotherapy Association had staff members available to inspect schools. Hence it was decided that the Council on Medical Education and Hospitals, because of its experience in this class of work, should undertake this survey and permanently maintain the list of approved schools.

On the recommendation of the Committee on Education of the Ameri-

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 7, 1936.

can Physiotherapy Association, in 1934, Dr. C. B. Reed, of Illinois, introduced a bill in the House of Delegates requesting the American Medical Association to establish standards and inspect and rate schools for physical therapy technicians. This work was assigned to the Council on Medical Education and Hospitals by the Board of Trustees.

The Council's Survey

During the past two years the Council on Medical Education and Hospitals has been engaged in the inspection of schools for physical therapy technicians. This survey included thirty-five schools. Each was visited personally by a member of the Council's staff and a first-hand study of the organization, faculty, clinical facilities, curriculum, records, and so forth, was made.

Many of you have already read the report of the Council's work in *The Journal of the American Medical Association* for August 29. This report includes the "Essentials of an Acceptable School for Physical Therapy Technicians" developed by the Council with the cooperation of the American Congress of Physical Therapy and the American Physiotherapy Association and passed on by the House of Delegates at the May session of the American Medical Association in Kansas City. These "Essentials," applied to the individual inspection reports and to the more recent questionnaires received from each school, resulted in placing thirteen of the thirty-five schools in a position to be approved by the Council. Several other schools will be eligible for recognition with certain changes; they may be placed on the list as they comply.

Obviously, time does not permit inclusion of the "Essentials" in this paper. Copies of the "Essentials" and reprints of the list may be secured on request from the office of the American Medical Association, 535 North Dearborn Street, Chicago.

It may be of interest, however, to consider briefly a few items in the content of the "Essentials."

1. A proper organization is required. "A school for physical therapy technicians should be incorporated as a nonprofit institution." The inclusion of the word "nonprofit" is altogether appropriate and automatically excludes, without further consideration, the commercial schools.

2. "Affiliation with a college, university or medical school is highly desirable, but is not an absolute requirement."

Eleven of the thirteen schools included on the first list approved by the Council are conducted by or affiliated with institutions of higher learning. The other two are conducted by hospitals — one governmental, the other voluntary. This requirement recognizes the very definite trend of universities and colleges assuming responsibility for this type of education, with hospitals and other clinical facilities affiliated for practical training.

3. Under "Faculty" a competent teaching staff is required but "the question of full time and part time appointments is not as important as the qualifications of the instructors. . . ."

4. Clinical facilities must be adequate and located in hospitals or other institutions acceptable to the Council on Medical Education and Hospitals.

5. It is required of an acceptable school that there be additional resources other than the income from students' fees. "Experience has shown that a modern school of physical therapy cannot be maintained as a rule by the income from students' fees."

6. It is stipulated under "Administration" that there be an executive officer of ability who by training and experience is fitted to interpret the

prevailing standards in physical therapy education. Satisfactory records should be maintained showing credentials, attendance, grades, and so on, by means of which an exact knowledge can be obtained regarding each student's work. Such records should be open to inspection by members of the Council's staff.

7. Under "Requirements for Admission," three avenues of entrance are open:

a. Two years or sixty semester hours of college, including courses in physics and biology.
b. Graduation from an accredited school of nursing.
c. Graduation from an accredited school of physical education.

Two years of college obviously is not the equivalent of graduation from an accredited school of physical education; however, it is considered best for the present to allow this wide latitude in entrance requirements.

Advanced standing is permitted in order that students may transfer from one acceptable school to another.

8. The school should issue, at least annually, a bulletin setting forth the character of the work offered.

9. The minimum curriculum outlined in the "Essentials" has been carefully worked out by representatives of the interested groups. A minimum 1,200 hours are required with 470 in theory and 730 in laboratory and practice training. Anatomy is particularly stressed and it is suggested that material should be provided to enable each student to dissect or have the benefit of demonstration of dissection of at least the lateral half of the human cadaver. Forty-five hours of electives are allowed in order to provide additional training in subjects particularly desired by each student.

The length of the course shall be not less than nine months. Since most schools are affiliated with colleges or universities, this period was selected to correspond to the academic year. This would appear to be somewhat shorter than standard courses for other important groups of technicians. Occupational therapy requires twenty-five months, clinical laboratory technology — twelve months, and dietetics — twelve months.

Registration

The personnel of any hospital department is its own limiting factor and is therefore of first importance. Thorough basic training in all important phases of physical therapy, such as is contemplated in the "Essentials," is absolutely necessary in order that the technician may be able to interpret and execute properly the orders of the physicians. She must be thoroughly imbued with the idea that no treatments are to be given without a physician's order. Candidates for admission to schools, in addition to having an acceptable educational background, should be considered from the standpoint of health, personality, and adaptability to the work.

In 1935, in consultation with the Council on Medical Education and Hospitals, the American Congress of Physical Therapy established the American Registry of Physical Therapy Technicians. The objects of the Registry among others are:

> To maintain the minimum standards of educational and technical qualifications as given by the Council on Medical Education and Hospitals of the American Medical Association for technicians administering physical therapy in hospitals, clinics and physicians' offices.
>
> To cooperate with the Council on Medical Education and Hospitals of the American Medical Association in its investigation, classification, and periodical inspection of schools. . . .

The machinery of the Registry including the actual examination of candidates has already been placed in operation. Hospital staffs and hos-

pital administrators will come to regard registration of physical therapy technicians fully as important as registration of other groups of medical technologists for which registries have been previously established.

The Council in its periodic inspection of hospitals emphasizes the need for qualified medical aides in all departments. Qualifications of personnel are requested in all departments, and where technicians are used, the matter of registration is made a point of inquiry. In addition to the hospitals, clinic groups and individual physicians with large practices are demanding adequately trained physical therapy technicians. The old method of each hospital department or physician training his own technician is definitely passing. The education of physical therapy technicians is now undergoing an evolution comparable in many respects to that which took place in nursing education during the past three decades.

Limited Registration

A member of the Congress recently proposed that some form of recognition be considered for technicians trained in only one phase of physical therapy, such as is now in use by the Registry of Biophysical Assistants in England. Examinations are given by that registry limited to massage, exercise, electrotherapy, or radiant energy, and provide a basis for registration in one or more of these fields. With hundreds of partially trained but capable physical therapy technicians, this proposition might on first thought appear to be highly desirable.

Such an undertaking would mean conducting special examinations for each of the major branches in physical therapy. The question of acceptability of training would be a major consideration. Schools for training in individual branches of physical therapy of which there are many, would expect recognition. This would be especially true of massage. Standardization of such training schools would doubtless constitute a serious problem. The wisdom of any official recognition of limited schools is seriously questioned.

The present system of registration, that is, of registered junior physical therapy technicians and registered physical therapy technicians, seems to be a practical method to begin with in considering the future of physical therapy education.

Technicians well trained in one particular branch, but unable to pass an examination in the entire field for registration, should by no means be deprived of their places so long as their work is accpetable to the physicians who employ them. The work of the Registry and the maintenance of the list of approved schools over a period of years will have a curbing effect on commercial schools offering partial training, and as time goes on there will be a gradual elimination of such schools.

Some manner of designating qualified physical therapy technicians according to the department in which they have had most experience and in which they are concentrating their time and study would be useful. Recognition might be given in the roster of certificatees of the Registry to those who, in addition to completing the prescribed course, have had sufficient postgraduate training or experience in electrotherapy, massage, exercise, or other branch to warrant the use of a special symbol following their names as "M" for massage, "EL" for electrotherapy, "E" for exercise, and so forth

Limited registration for those not having the prescribed basic course would open the way to recognition of large numbers of pseudo-technicians, and might easily become a means of promoting further commercialization and independent practice. This consideration does not fall within the jurisdiction of the Council on Medical Education and Hospitals, but must be decided by the Board of Registry of the American Congress of Physical Therapy.

Continued, persistent effort will be necessary by this Congress, the American Physiotherapy Association, and the Council on Medical Education and Hospitals, to bring more schools to adopt higher educational standards, to show technicians the desirability of holding certificates issued by the Registry, and to further encourage hospitals, clinics and physicians to employ only qualified technicians.

THE AMERICAN REGISTRY OF PHYSICAL THERAPY TECHNICIANS *

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CHICAGO

The American Registry of Physical Therapy Technicians is a recently created organization under the auspices of the American Congress of Physical Therapy. As the majority of the medical profession is not acquainted with its aims and functions, it is deemed proper to preface the following report with a brief sketch of its history.

For some time the American Physiotherapy Association, composed exclusively of physical therapy technicians, made a praiseworthy effort to maintain a satisfactory standard of their moral and professional qualifications. Under the conditions then existing, there was no authoritative body sufficiently interested in the educational qualifications of this class of technicians. As a result the Association took matters in its own hands to stem an influx of self-appointed technicians and to maintain the reputation of trained, conscientious workers.

Many complaints reached the public that "massage parlors" and similar undertakings were run for improper purposes. There arose the danger that respectable women devoting their lives to a service of caring for the sick might become tarred with the same brush.

I shall not discuss the qualifications set up by the American Physiotherapy Association, and will limit myself to the statement that this association maintained a list of approved training schools for physical therapy technicians. That this list was prepared only after a careful investigation of the quality of the curricula, is evidenced by the fact that about five years ago two schools were stricken off because they were not affiliated with academic institutions and maintained themselves solely by the fees paid by the students. It was assumed that many graduates of such a type of training school would be unable to meet the requirements for admission to membership in the technicians' association.

It eventually became evident that like nurses, physical therapy technicians could not be left to work out their own destinies. As a result, about four years ago representatives of the American Congress of Physical Therapy, and its affiliated organizations, The New York Physical Therapy Society, and the Pacific Physical Therapy Association, met and decided that it was the prerogative and duty of specialists in physical therapy to prescribe the

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 7, 1936.

qualifications of their technicians and formulate the relation of the latter to the medical profession.

The American Physiotherapy Association did not at once fall in with this decision, though in justice to that body it should be stated that this was at least in part owing to certain misunderstandings. The leaders of the association expressed a fear that the standards of the diverse training schools might be lowered; that perhaps inadequately trained women might somehow gain preference; that the official publication of the American Congress of Physical Therapy might by force of circumstances absorb their own bimonthly magazine.

These issues raised by the representatives of the technicians were soon enough realized to have no foundation in fact. Unfortunately this cannot be said about an objection of a more material nature advanced by the same organization. Somehow they became possessed of the unworthy idea that the medical body organized to assume control over the physical therapy technicians was motivated by a desire to increase its revenues. To what extent this uncalled for assumption still persists among the members of the technicians association can, of course, not be determined with exactness; it suffices to know that it still exists. These technicians do not consider that they impugn the motives of a recognized national body of physicians and surgeons, on whom they depend for their livelihood and without whose good will and cooperation their work would come to naught. The best that can be said in defense of the concerned technicians is that allowance should be made for human nature, which often appreciates only one's immediate benefit and fails to realize the common good.

One of the circumstances that clearly revealed the need for authoritative control of physical therapy technicians was that quite a number of them arrogated to themselves the role of independent practitioners. They opened offices of their own, solicited practice by advertising, and actually entered into competition with the regular medical profession. It became evident that effective measures were necessary to stem a movement which was sure to grow into what is perhaps best described as another pseudomedical profession. Parenthetically it may be stated that the American Congress of Physical Therapy and other large scientific bodies are planning measures to cause an abandonment of the pernicious practice of accepting advertisements from independent technicians.

Origin of the Registry

In 1932 the President of the American Congress of Physical Therapy appointed a committee with authority to take appropriate measures definitely to secure a satisfactory status of all physical therapy technicians. After exhaustive consideration of the many more or less complicated problems, it was decided to invoke the assistance and collaboration of other interested, authoritative bodies. Thus the Council on Medical Education of the American Medical Association was solicited to undertake inspection of all existing training schools. The committee also decided not to create within the Congress sections or auxiliaries consisting of physical therapy technicians, deeming it advisable that for their professional and social development the American Physiotherapy Association should remain autonomous.

At a subsequent date the committee approached other distinguished bodies. In each case it was held that the American Congress of Physical Therapy was the logical body to create a Registry of Physical Therapy Technicians with power to issue certificates to candidates passing an adequate examination.

We now come to the actual establishment of the Registry. From its

very inception it availed itself of the experiences gained by the registries of the American Society of Clinical Pathologists and of the Radiological Society of North America. The procedures in vogue with these two representative bodies were carefully studied and as far as applicable utilized by our Registry.

Our Board of Control is composed of seven members of the Congress who devote their entire interests to the science and practice of physical therapy. This Board is in frequent consultation with an advisory group composed of representatives of several national specialistic societies. Standards have been set up and procedures adopted which are essentially identical with those for laboratory technicians. Certainly no objection can be raised to the conditions imposed on registered physical therapy technicians, because they are no more exacting than those that have been established for laboratory technicians. The best proof of the fairness of the examinations held is furnished by the comparatively large number of men and women technicians, who have expressed to me, as Registrar, their full satisfaction with the manner of their tests.

The examinations consist of oral, written and clinical tests in keeping with the essential knowledge every conscientious technician should possess. Such tests are aimed as much for the protection of the candidates in their careers as to insure the safety and well being of patients. When it is ascertained that a candidate is lacking in one or more subjects, the deficiencies are pointed out and advice is given concerning further preparation.

The subjects covered in the examinations are elementary anatomy, physiology and pathology, massage, electrotherapy, corrective exercises, radiant energy, simplified hydrotherapy.

Rules Governing Examination

The following rules adopted by the Board convey a better idea of the procedures of the examinations than can be had from a lengthy description. It should be borne in mind that these rules have been necessitated through the circumstance that tests are held at widely separated places and also at times other than at each annual meeting of the Congress. The rules are:

1. Questions are sent to the examiner under two labels, one for Registered Physical Therapy Technicians; one for Registered Junior Physical Therapy Technicians.

2. The examiner receives from the Registrar a list of those entitled to take the examination for each group. Each candidate must file an application with the Registrar in Chicago where the following records are kept:

   a. — Application properly filled in.

   b. — Official notarized transcript of former school credits, with actual or photostatic copies of diplomas or nurses' registration cards.

   c. — Two references from reputable physicians.

3. Examinations will be given by the examiner or some person designated by him, either one remaining in the room during the tests. Sealed examination questions will be sent to the examiner for each applicant, and will be opened by the candidate. Sufficient time will be allowed for completion of the examination. Experience has shown that the written examination requires from five to six hours.

4. At the completion of the examination the questions and answers are turned over to the examiner, who will check the questions and answers in the following subjects: Anatomy, exercise, electrotherapy, hydrotherapy, massage, pathology, physiology and radiant energy.

5. Examiners, who are members of the Board, are instructed to mark each paper and return it to the Registrar in envelopes provided for this

purpose. All papers for candidates for the certificates of registered physical therapy technician are scrutinized and graded by each individual member of the Board. Oral and clinical tests are graded and reported by each examiner. Certificates for registered physical therapy technicians are issued *only* on the unanimous recommendation of the Board. The written papers for junior registered physical therapy technicians do not require control by all members of the Board.

Before issuing certificates each candidate pledges to observe a Code of Ethics which should be acceptable to all right-minded individuals.

The fee for examination and registration is $10.00, and is not returnable in case of failure. The applicant may, after the lapse of six months, be given the privilege of another examination without additional charge.

Comments

It has been suggested that each State Medical Society should appoint a committee to formulate regulations governing the employment of technicians in all branches of medicine. It was concluded that state regulation would be unsatisfactory, because of the danger of great variations. Possibly only six or seven of the larger states would adopt such a plan, and technicians moving from one state to another would experience invalidation of a previous compliance.

It is gratifying to note that the American Hospital Association has indorsed the work of the Registry in its official publication. The Association has expressed its intention to recommend to all hospitals to employ only technicians holding certificates of the Registry.

Conclusion

There is need of stressing the desirability for whole-hearted cooperation between the medical profession and physical therapy technicians.

A beneficial relationship can be attained only by the conscientious and accurate discharge of duty by the latter under the direction of qualified physicians and never through independent practice.

The Registry has been organized for the purpose of safeguarding patients from incompetence and of furnishing hospitals, sanatoria and physicians with lists of qualified technicians.

THE CANCER CLINIC IN MEDICAL AND DENTAL SCHOOLS *

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Since 1900 vital statistics in various large centers of population and in all registration districts throughout the United States have shown a steady rise in cancer mortality, until, at present, cancer is second only to cardiovascular diseases as the cause of death. (Some statistics place pneumonia second and cancer third.) The question naturally arises: "Why the increase in cancer deaths and is it real or apparent?" Several facts come to the fore in the study of this question.

In the last 50 years advances in scientific medicine have changed the

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 7, 1936.

order of death-dealing diseases. A half century ago, communicable diseases — plague, smallpox, diphtheria, typhoid, infant dysentery, malaria, yellow fever, tuberculosis — were the great scourges of the civilized world. One by one these epidemics have been conquered. The "white plague," which at one time lead in the cause of death, is now far down the list. . . . Most of these infectious diseases took their toll of death from infants, children and young adults, so that the average age of our population about forty or fifty years ago was about thirty-five. As infectious diseases were controlled, the average age of man has gradually increased — until today it is fifty years or more. This means that people living through the average age of fifty will die of diseases occurring in the latter years of life. One of the chief of these is cancer. Cancer is recognized as a disease of middle and late life, although we are continually seeing cancer in the younger ages. Cardiovascular diseases, nephritis, and the like, are also diseases of later life and are now prominent in the cause of death as compared to a few decades ago, even ahead of cancer.

According to the statistics of the New York Health Department, there is not an actual increase in the percentage of death caused by cancer in the various age groups.

This report charts the cancer deaths for the various decades of life, including the years ten to eighty. Although many more people live to the upper decades of life (above forty) than formerly, the percentage of deaths from cancer in the upper brackets is no larger than it was in 1900.

Other factors bearing on the increase in cancer deaths throughout the country are more accurate vital statistics, correct diagnosis by x-rays, pathologic studies, and more exact diagnoses by operation.

Interpret these data as one will, cancer is second in the toll of death throughout the country. This means that it is of paramount importance to teach medical and dental students the early symptoms of cancer and to make them "cancer conscious," so that they will recognize all types of premalignant diseases during routine examinations. The student should learn enough of the essentials of cancer therapy properly to direct patients for treatment. He should also realize that at present there is no cure-all, but much can be done to cure early cases or palliate the late ones, and that practically speaking each cancer case is a rule unto itself, so far as therapy is concerned. There is sufficient regularity in the response of certain groups of cancer to surgery, irradiation or electrosurgery, to render important the proper selection of therapy in each case.

Cancer patients still come to the physician in advanced stages, due to their ignorance or fear, indicating that more public education is needed. Experience shows that many patients come late because the physician has not paid attention to symptoms which should suggest cancer, especially of the internal organs. Frederick L. Hoffman, consulting statistician for the Prudential Insurance Company of America, in 1923, said: "It is a scandalous indictment of negligence on the part of a considerable portion of the medical profession who permit cancer cases to drift along until chance of an effective operation has passed." This situation is fast disappearing, thanks to better cancer education in the profession and especially in the medical and dental schools. In the last five years I have noticed an increase in the number of young physicians and dentists sending pre-cancer and early cancer patients for treatment. Many of these, of course, were students in our cancer clinic — indicating the value of our cancer education, but there is still room for improvement in the teaching of oncology. Frank E. Adair of the Memorial Hospital, New York, adds to the improved outlook in the cancer problem by stating: "In 1928 there were only thirteen institutions

in America which measured up to the standard of equipment and trained personnel required by the American College of Surgeons for a cancer clinic. Today there are nearly two hundred cancer clinics which meet the requirements; and a large number of others are seeking to meet the minimum standard. Cancer clinics are now filling an urgent need."

Function of the Cancer (Oncologic) * Clinic

An organized cancer clinic, whether in connection with a medical or dental school or hospital, serves the patient better than the otherwise heterogeneous teaching of oncology or the treatment of cancer in medical, surgical or specialty clinics. Cancer clinics are usually headed by one or more men trained in the important methods of treatment, who have, therefore, better judgment in the diagnosis and selection of treatment for the patients. The cancer clinic acts more or less as a "clearing house" for borderline cases and directs suitable ones to the surgeons, radiologists, or both, as the case may be. In the well-organized cancer clinic, there is a more accurate check on the completion of pre-operative and pre-therapeutic studies—blood counts, Wassermanns, x-rays, biopsies, and photographs. These are of exceptional value in diagnosis and treatment and, therefore, emphasizing to the student the importance of care and thoroughness in handling the cancer patient. The plan of treatment in the clinic is consequently well-rounded and unified, a desideratum not so effectively attained when the patient is sent from one clinic to another without centralization.

The cancer clinic should maintain liberal consultation with all other departments. Many of the patients are admitted to the clinic directly, others are referred from various departments in the hospital and dispensary — in-patients as well as out-patients. In either case, frequent, liberal aid of consultants is an advantage to the patient, the student and the physician. The cancer clinic then furnishes more concentrated teaching facilities for both medical and dental students. This cooperation of teaching of oncology should begin in the pathologic department, continued throughout the clinical subjects and finally summarized and made more specific in the therapy in the cancer clinic and lecture courses in the department of oncology. Classification of growths and their reaction to treatment, types of treatment and combinations of therapy, must be uniform in the pre-clinical, as well as clinical curriculum, for the student to better utilize his preparatory studies in the advanced years. In the oncology courses, students are taught in the dispensary, ward classes, hospital and by lecture courses, so that in the third and fourth year they are in constant touch with all angles of the cancer problem.

By having a cancer clinic directly connected with medical and dental schools, better opportunity is offered to study the material at hand, in the form of (a) case studies, (b) evaluation of results of treatment, and (c) clinical research.

Organization and Personnel. — The staff of the cancer clinic should be an adequate and, if necessary, a large one. The American College of Surgeons laid down in its "First Report of the Committee on the Treatment of Malignant Disease," certain standards of personnel and "takes the stand that cancer is a surgical problem. The diagnosis and treatment of cancer is recognized as a responsibility of the surgeon, or radiologist, who has had surgical training, and he should be qualified for this work by experience in the surgical pathology of tumors and in the employment of radiation methods, as well as surgery, for both the radical and palliative treatment of cancer; and that he should work in close cooperation and consultation with

* "Oncology" is used in place of "cancer" that the patient be not frightened.

the radiologists in the use of x-ray treatment." In further establishing the cancer clinic staff, the committee emphasizes the necessity of having roentgen therapy, radium therapy, electrosurgery, pathology, and all the various specialties represented. It means then that the cancer clinic must be an integral part of the hospital and medical and dental schools, and so closely related to every department of the institution that their work may dovetail with one another.

In addition to the professional staff, a secretary and one or more social workers are necessary to keep accurate records, from which the students may be given first-hand information. Social workers are active in follow-up work, making it possible to summon any number of patients in varying stages of diagnosis and treatment, or in the arrested stage, for demonstration to the students.

Equipment. — In addition to the usual diagnostic and therapeutic armamentaria of the hospital, such as medical, laboratory and surgical facilities, three other agents are necessary: X-ray therapy (both high and low voltage), radium element or radon, in sufficient quantities for good work, and a good, modern, electrosurgical apparatus, supplying desiccating, coagulating and cutting currents. For teaching purposes an oncologic museum is especially important. This should contain photographs of patients before and after treatment, accompanied by photomicrographs of the tumors and, when available, photomicrographs emphasizing the biophysical reaction of therapeutic agents on normal, as well as pathologic tissue. Wax moulages furnish at all times excellent material illustrating the clinical stages of the disease and the treatment.

Records. — It is needless to say that accurate records must be always kept in order to properly teach the students. The foregoing is a general outline of the cancer clinic in the medical and dental schools. Let it be said here that the teaching of oral oncology to dentists cannot be over-emphasized, as they are examining mouths many more times than the physician. Since we have had direct contact with dental students in the last three years, there has been a notable increase in the number of oral neoplasms in our tumor clinic and in private practice. These newly trained dentists are "cancer conscious" and whenever they see an abnormal lesion in the mouth, which is not purely a dental problem, the serious possibilities are immediately recognized and proper steps taken towards treatment.

It may be of interest now to outline the cancer clinic at the University of Maryland and its relation to the medical and dental schools. The University is a State institution and is in contact with physicians and dentists throughout the State and in neighboring commonwealths. This wide contact offers an ideal situation for the care of patients from a distance and for obtaining additional knowledge about tumors.

Relation of Student to Clinic

The cancer clinic is an integral part of the medical school under the department of surgery. There are regular dispensary hours and days for the oncologic patient and hospital beds, x-ray, radium and electrosurgery are available as needed. The medical students first come in contact with the clinic during their third year. One or two students are sent daily from the surgical group to the clinic. As a rule, each student has two days in the tumor dispensary. In this way, each member of the third year class has an opportunity to meet, examine and discuss the methods of treatment of cancer patients. Many follow-up cases are shown, so that the end-results can be observed. At the end of the third year, a series of six or seven special lectures, covering the fundamental principles of cancer therapy, are

given to the entire class. This lecture course dovetails in with their previous training in histology and pathology, medicine and surgery. The pathologic department has already taught them something of the radiosensitivity of tumors and the tumor courses elaborate on this. The students also receive separate lectures in x-ray therapy from the roentgenologist, and in their gynecologic course lectures in gynecologic oncology by one of the co-directors of the tumor clinic.

Throughout the fourth year, ward classes are held one afternoon a week, at which time various problems in tumor therapy, illustrated by patients, are discussed before small groups of fifteen or sixteen students. Each group meets for five or six hours. At the end of the fourth year, examinations are given over the work of the entire two years. Throughout the two years, the oncologic course is supplemental to the cancer training in various other departments of the medical school.

One of the directors of the cancer clinic (the writer), is also lecturer in oral oncology in the dental school, which is located on the same campus as the hospital and out-patient department. There is free liaison between the dental dispensary and the tumor dispensary. The Oral Department of the dental school has an agreement with our Oncology Clinic that all oral tumors coming through their dispensary shall be loaned to our clinic for investigation and teaching purposes in reciprocity for our loaning all our oral tumors to the dental school for the same objects. This gives both schools marked increase in all tumor pathology. In conjunction with the oral surgeon of the dental school, the Oncology Department has adopted a routine for the treatment of cancer of the mouth to be followed for a number of years, so accurate studies can be made. This close cooperation gives opportunity for the oncologists to teach the dental students in a little different fashion than they can receive from their own staff. The fourth year dental class is given a series of lectures on oral oncology followed throughout by demonstration groups for the discussion of specific problems illustrated by patients, which come from the hospital, the out-patient department, or the dental clinic. The presence on the hospital interne staff and of a resident dentist enhances the close relationship between the tumor clinic and dental school and improves the attention given to patients from both departments.

Summary

The cancer problem is rapidly becoming one of the most vital before the medical profession today. Medical and dental schools throughout the country should have in their curricula special courses in oncology, for study of the diagnosis and treatment of cancer by surgery, radium, x-ray or electrosurgery. Many of the older physicians did not have the benefit of such specialized education. As the more recent graduates of medical and dental schools go out into practice, they are capable of recognizing pre-cancerous lesions and early cancer, thereby contributing a great part to preventive medicine.

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THE ROLE OF PHYSICAL THERAPY IN FRACTURES *

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Physical therapy in the treatment of injuries was used at least as far back as the time of Hippocrates, for he described the use of massage and passive motion following reduction of dislocations of the shoulder. During the days of the Roman Empire, hydrotherapy was used extensively. Undoubtedly the beneficial effects of massage and heat were understood by the Greek and Roman physicians.

In modern times the pioneer in the use of physical therapy in the treatment of fractures was Just Lucas-Championnière. In 1862, while still a medical student in Paris, he became interested in massage. During his interneship from 1866 to 1869 he never lost an opportunity to employ it in the treatment of his cases. In 1867 he observed a fracture of the lower end of the radius in a woman of 76. This patient continued to use her arm and obtained good union and an excellent result. This experience struck him very forcefully and influenced him to begin experimenting with a new method of treating fractures by massage and mobilization.

At that time the orthodox method of treating fractures was by prolonged immobilization. The results were uniformly bad. Deformity and shortening were the rule and no attention was paid to the musculoarticular system upon which the function of the extremity depends. Championnière observed these cases coming back to the clinics for months and years complaining of pain, swelling and stiffness of their joints and inability to use their limbs. The sight of these cases must have convinced him that there was a better method of treating fractures.

Beginning with fractures of the fibula and lower end of the radius, he gradually extended his methods to include all fractures. From a functional point of view his results were excellent. He did not use this method to the entire exclusion of splints. But he did not apply splints with merciless disregard of the soft tissues. He removed the splints every day or every second day and applied gentle massage to the extremity. He had observed the soothing and relaxing effect of massage and he found that following its use he could move the involved joints without pain to the patient.

His results were undoubtedly remarkable compared with those of his colleagues. It cannot be said that his cases never had shortening or deformity, but he did obtain mobile joints and useful extremities. He fully appreciated and frequently quoted the axiom of Aristotle that "movement is life." He saw clearly what his colleagues failed to see — that restoration of the function of an extremity was the result to be desired in the treatment of fractures.

It must be remembered that there were no x-rays during the time of Championnière. Errors in diagnosis were made. The accuracy of reduction and the state of the callus could only be checked by clinical observations. As was to be expected when something new is brought out, Championnière's method was not accepted by the medical profession of his time, but the importance of his contribution to the treatment of fractures cannot be over-

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 8, 1936.

estimated and is now generally recognized.

Mennell took up this method which he had studied at first hand in Paris. In England conditions were somewhat similar to those in France. Bone setters flourished on cases which the regular physician failed to cure. In explaining this situation Mennell says: "The bone setter thrives not because people suffer injury, but on account of the treatment they receive. The doctrine of fixation, rest and splintage is his great ally; his enemy is treatment of recent injury by mobilization."

Lessons of the World War

The World War brought about many changes and improvement in our methods of treating fractures and gave great impetus to the field of physical therapy. Many thousands of wounded men had to be rehabilitated. Physical therapy played an important role in this work and at the same time its knowledge became disseminated to a much greater extent among the profession.

Industrial compensation laws have also had an important influence on the development of physical therapy in the treatment of fractures. The demand for shortening the period of disability in fracture cases has been met by the proper use of physical measures.

What we strive to accomplish in the treatment of fractures is a complete restoration of function in the shortest possible time. Obviously, from the nature of many injuries a complete functional restoration is not possible. We must aim in such cases to reduce the disability to a minimum.

In order to treat fractures one must meet the requirements necessary for the union of the fragments in good position and alignment, and at the same time keep the musculoarticular system in as near a normal condition as possible, so that functional recovery will take place with the least delay after healing of the fracture. This is where physical therapy does the most good. If we wait until the fracture has healed before starting it, the golden opportunity has passed, and prolonged and often times permanent disability results which should have been prevented. Reduction and fixation is necessary to obtain healing of a fracture. Bohler states that complete and uninterrupted fixation is necessary to gain this end.

Those who treat fractures must be ever painfully conscious of the fact that fixation is the worst possible thing that can happen to muscles and joints. Muscles atrophy with surprising rapidity. Fibrosis and loss of elasticity occur and contractures develop. Pathologic changes take place about joints which limit motion. All of these are the result of immobilization.

It is these ill effects of immobilization that physical therapy must prevent and can prevent to a large degree if used early and judiciously. To wait until all of these ill effects have developed means a return to conditions as Championnière found them. Every surgeon who has much experience with fractures occasionally sees such cases. It may be an old Colles' fracture with fibrosis of the interphalangeal joints due to lack of exercises, or perhaps an old fracture of the humerus which has been treated with the elbow in extension for a prolonged period, or it may be a fracture of the tibia which has been immobilized with the foot in equinus position. Any one who is familiar with the advantages of judiciously applied physical therapy would not allow these things to happen. Fortunately, one now sees fewer of these cases than formerly, which clearly indicates that the standards of treatment are constantly improving.

Modern Methods

Open reduction, suspension-traction and especially skeletal traction have been the outstanding advancements in fracture treatment in recent years.

More perfect reduction can be obtained by these methods and they allow a much earlier use of heat, massage and joint movement without danger of displacement of the fragments. Everything else being equal, the more perfect the reduction of the fracture, the more perfect should be the ultimate functional recovery. This statement is borne out by an investigation of the Fracture Committee of the British Medical Association who studied the late results of a large series of fractures.

Fractures do not heal with any degree of uniformity. Many factors influence callus formation, some of which are not thoroughly understood. The age of the patient, the location and type of fracture, local conditions about the fracture, and the type of treatment are all important. Union occurs most rapidly in cancellous bone and very slowly in dense cortical bone. These things must all be considered in prescribing physical therapy for patients.

Some surgeons are of the opinion that movement at the site of a fracture stimulates callus formation. Others believe that absolute fixation is necessary. I can not subscribe to the former theory as I believe movement at the site of fracture damages callus and may result in a pseudoarthrosis. On the other hand, we often see a delay in callus formation when fractures are firmly fixed with Lane plates. I believe that stress and strain as expounded in Wolff's law stimulate callus, and this can be brought about by active contraction of opposing muscle groups and by active movement of joints. In other words, I believe we should simulate normal function as much as is possible and compatible with the condition of the fracture. Anything we can do to maintain the tone and nutrition of muscles will favor the production of callus.

Only the simple types of physical therapy are needed in the treatment of fractures. Elaborate and expensive equipment is not required. What is necessary is thoroughly trained technicians who understand the problems involved in fracture treatment. There must be the closest cooperation between the surgeon and the physical therapist. The confidence and cooperation of the patient is necessary. He must understand that there is a great deal he must do for himself. If he does not actively contract his muscles and move his joints he will not obtain the greatest benefit from his treatments. He must be given specific instruction as to how much exercise he is to take and just how he is to take it. Massage, heat and exercises are the usual forms of physical therapy applicable to this condition. Light massage is used for its soothing and relaxing effect usually preliminary to the movement of joints. Deeper massage is used to aid the lymphatic and venous systems in carrying off the products of edema and hemorrhage. Heat is soothing and relieves pain and also causes an increased flow of blood to the affected part. It is used as a preliminary to massage and movement. The effects of the various forms of heat are essentially the same. Movements may be active, passive, assistive, resistive. All have their place in the progress of the treatment.

Physical Therapy

Time does not permit of a detailed discussion of the role of physical therapy in the treatment of individual fractures. A few of the most important ones deserve consideration. Standardization is impossible and the treatment must be suited to the individual case.

Impacted and incomplete fractures and fractures without displacement require only light protective immobilization, and physical therapy can be started as soon as the patient reacts from the effects of the accident. Such fractures are ideally suited to the method of Championnière. Impacted fractures of the head and neck of the humerus occurring in old people fall into

this class. The arm can be placed on an abduction splint with sufficient skin traction applied to the upper arm to control muscle spasm. Thus the patient is made comfortable and ambulatory.

Heat and massage to the shoulder can be started almost at once, followed by gentle passive motion. This will be followed at the proper time by assistive and finally by full active motion. Active movements of the elbow, forearm, wrist and fingers must be kept up from the beginning. Excellent functional results can be obtained in this way even when the x-ray shows considerable deformity of the head and neck of the humerus.

Fractures of the shafts of the long bones require a longer period of immobilization. In the humerus and femur, suspension traction is the method of choice; skeletal traction is preferred to skin traction. In fractures of the femur, with the limb suspended in a Keller half-ring splint, there is no undue restriction of the muscles. Quadriceps exercises can be started as soon as the fragments are fixed by callus. These, with heat and massage, will retain the strength and elasticity of the muscles. Active movements of the ankle and toes should be carried out from the beginning. At the end of from 4 to 6 weeks the Pierson attachment can be used to give knee motion. By means of a rope and pulley the patient can give himself active, passive and assistive exercises. In favorable cases the patient should have 70 degrees of active knee flexion by the time the callus is strong enough to permit removal of the traction. At this stage forcing of the knee is indicated. If the patient is industrious he can materially shorten his convalescence by taking regular systematic exercises each day.

In fractures of the humerus the principles are exactly the same. The Blake or Bohler type of traction may be used. Movements of the elbow should be started as soon as possible. Active exercises of the hand, wrist and forearm should be kept up from the start.

Colles' fractures should be immobilized with the metacarpal and interphalangeal joints left free. With systematic exercises for the fingers, elbow and shoulder, convalescence is very short after the splints are removed.

All fractures of the olecranon with separation should be firmly fixed with wires and put up with the elbow at a right angle. Return of motion is more rapid than when the joint is put up in extension. Fractures of the metacarpals are difficult to treat and often disabling. Traction seems to be the best method. Flexibility of the fingers is difficult to recover. The use of a rubber sponge which the patient can grip is very beneficial.

Like conditions about the knee and ankle require accurate reduction if serious disability is to be avoided. If accurate reposition cannot be obtained by manipulation, open reduction is necessary. All joint fractures should be mobilized early if good function is to be expected, the exceptions being fractures of the neck of the femur and of the carpal scaphoid, which require prolonged immobilization, and any attempt to hasten them will probably be regretted.

In immobilizing joints they should always be put up in a position of maximum function, and the force of gravity should be used as an aid to the recovery of motion and not as an impediment. With these points in mind we should always immobilize the shoulder in abduction, the elbow in flexion, the wrist in dorsiflexion and the foot at a right angle to the leg.

I have attempted to outline the principles involved in the use of physical therapy in the treatment of fractures and have pointed out its use in some specific instances. In dealing with a subject so broad one can only mention a few of the salient details. From what has been said it is evident that there has been an ever increasing use of physical therapy, and the results speak eloquently for themselves.

EFFECTIVE EUROPEAN METHODS OF HYDROTHERAPY NEGLECTED IN UNITED STATES *

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On the basis of twelve years' of observation of physical therapy in Europe, in which I participated, I submit that out of every one hundred patients receiving physical treatment in Europe under medical supervision, seventy-five are treated by means of hydro-balneo-therapy, and only twenty-five by electrotherapy. I can safely state the reverse to be true in the United States. Europe's reputed spas are scientific centers of hydrotherapy, as are the efficient and busy hydrotherapy clinics of the various universities. There are scores of well equipped hydrotherapy institutions under medical supervision in the larger cities.

No doubt European handbooks of hydrotherapy place too much importance upon technical detail, offer too many hydrotherapeutic prescriptions, but most of these methods are the result of empiric observation of medical generations, and most of these prescriptions survived critical analysis of biological research. The two most important survivals of the acid test of modern biology are: 1. carbonic acid water baths, 2. peloidtherapy, the different mud treatments.

Carbonic Acid Water Baths

The waters of CO_2 saturated mineral springs were first used for bathing in the treatment of cardio-vascular diseases by Benecke in the middle of the last century. The good clinical results of these treatments encouraged the use of artificial CO_2 baths for the same diseases. In the artificial carbonic acid baths, the CO_2 is either developed from chemicals dissolved in the bath, or is conveyed into it in some places in plain gas form, in others as a highly concentrated carbonic acid water.

To prepare a CO_2 bath chemically, about 2 lbs. of sodium bicarbonate has to be dissolved in the water of the bath and followed, after the patient is conveniently placed, by an addition of acetic or formic acid. These acids should be preferred to inorganic acids, as they do not corrode the metallic parts of the bath tub. Potassium bisulphate and sodium bicarbonate, as CO_2 developers, are advisable combinations for the purpose, as the resulting CO_2 development is of even and of longer duration. To render artificial CO_2 baths more like natural ones, we have apparatus which prepare CO_2 saturated waters under one and one-half to two and one-half atmospheric pressure. The best known are Fisher and Kiefer's in Karlsruhe, Germany, or Max Paschka's, in Vienna, Austria. In the former the saturation occurs in a metal cylinder; in the latter, in a small metal box. The water is dispersed in these apparatus by different devices (marble balls, crushed coke, or shower-rose) to augment the degree of saturation. The CO_2 saturated water is slowly conveyed, without stirring, into the bath tub, already filled with hot water (60 degrees C.). The difference between the natural and artificial CO_2 baths is not marked, CO_2 being a simple and well defined compound.

The advantage of natural CO_2 baths lies in the patient being compelled to leave his environmental troubles and to devote his entire time to recuperation. On the other hand, artificial CO_2 baths can be taken without wait-

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 10, 1935.

ing for the season when the vacation starts, and are not hurried, because the vacation is short.

The CO_2 baths cause a peculiar, fine, prickling sensation due to settling of small gas bubbles on the skin; a comfortable feeling of warmth develops, even in cool CO_2 water baths.

After a few seconds of a negative phase, we observe the following symptoms: 1. a deepening of respiration; 2. lowering of pulse rate; 3. lowering of blood pressure; 4. increased volume of the pulse; 5. intense reddening of the skin, up to the level of submersion.

Series of experiments proved an absorption rate of about 200 cc. of CO_2 gas per minute through the human skin. The absorption is well compensated by an increased respiratory volume, without causing measurable changes in the pH quotient of the blood. There is an increase in the minute volume of the cardiac output, (about 25 per cent), and an average 30 per cent increase in the output per beat — all these by a lowered heart-beat rate. A marked increase of diuresis can be observed as a rule in cardiac cases with edema after the baths.

Opinions differ as to the mode of action of the CO_2 water baths, but all agree they are beneficial in certain cases, and that they act by their mass, temperature, duration, and CO_2 content. The effects of a cool bath (CO_2 baths are given at the temperature of 34-30 degrees C.) are well known: they stimulate, raise the muscular tone, increase blood pressure, pulse volume, and depth of respiration. These effects are modified by the specific effects of CO_2 on the human skin.

The submerged parts of the human body will be quickly covered with CO_2 bubbles which cling to the skin, producing a prickling sensation through mild irritation of the sensory nerve endings. The bubbles, the gas being a poor heat conductor, protect the underlying skin from the cooling effect of the water. Through the areas not covered by the bubbles, and so exposed, CO_2 absorption starts. Due to this absorption and to the fact that the CO_2, ordinarily escaping through the skin, is prevented from doing so, a stagnation of CO_2 in the skin, a "suffocation of the skin," develops. This reacts immediately upon the numerous nerve endings in the skin, producing an irritation of the thermo-sensitive end-corpuscles. A feeling of pleasant warmth, characteristic of even cool CO_2 baths, develops. The capillary network and the deeper lying arterioles dilate extensively (active hyperemia). Consensual dilatation of the arterioles of the kidney is proved by ensuing diuresis. Simultaneous dilatation of the coronary vessels has to be presumed, due to the protagonism of the two blood vessel territories. The above described effects of the CO_2 baths have an apparent similarity to the effects of the digitalis group, without the toxicity of that group.

While the relatively cool temperature of the CO_2 baths increases, the work of the heart, the specific CO_2 effects tend to ease it up, by lessening the resistance in the periphery. Suitably combining the temperature and duration of the baths with the degree of CO_2 saturation, we are able to increase or diminish the work of the heart, we can calm it and stimulate it simultaneously.

CO_2 baths offer suitable and pleasant therapy for all chronic cases of mildly or moderately broken compensation of the myocardium, independent of etiology. They can be used further with advantage in cases of:

1. Chronic pericarditis.
2. Aneurysms of low progression.
3. Moderate hypertension.
4. Chronic pectoral angina (Heberden's).

5. Raynaud's disease.

CO_2 baths are contraindicated in cases of:

1. Absolute insufficiency displaying:
   (a) Dyspnea even in rest.
   (b) Extreme edema.
2. Acute or threatened apoplexy (hemiparesthesia).
3. Severe or progressive aneurysms.
4. Precomatous states of diabetes, or kidney insufficiency.
5. Acute pectoral angina.
6. Coronary thrombosis.
7. Acute infectious diseases.
8. Extreme cases of arrhythmia.

The following simple rules of administration of CO_2 baths should be observed:

1. Begin with a temperature of 34 degrees C., lower it on subsequent baths. Do not go below 30 degrees C. in the aged.
2. Begin with a bath of five minute duration. Increase it to fifteen, but do not exceed twenty minutes.
3. The temperature of the bathroom should not be under 18 degrees C.
4. It is advisable to place a cold compress on the head of the patient prior to entering the bath. It should be changed several times while in the bath.
5. A soap and water cleansing of the skin preceding the bath will increase the rate of absorption, as will the addition of salt.
6. The patient should sit quietly in the bath.
7. The whole bathtub should be covered with a sheet, with only the patient's head being above it, in order to prevent inhalation of the CO_2 gas.
8. Patients should not dry themselves. An attendant should do it without rubbing.
9. A rest of a half to one hour after the bath should be insisted upon.
10. A complete CO_2 bath cure lasts from 8-12 weeks, with 20-30 baths administered every second or third day.

Mineral Mud Therapy

The treatment with muds is old but not antiquated. Recently an Austrian state committee was appointed by the government to register the Austrian muds, the finding places of which will become state reservations. The International Society of Medical Hydrology called a special meeting for classifying and subdividing the different types of mud. There are three main mud types, classified according to their diminishing silicate content: 1. purely mineral; 2. mainly mineral; 3. mainly vegetable.

1. A purely mineral mud is Fango, collected from the bed of volcanic mineral springs.

2. A mainly mineral mud is the sea mud or Limon, deposited on the bottom of shallow bays and inlets, containing microscopic shells of diatomea, fusillaria, and spongilla needles, all of them cadavers of the "one-cell life" of the ocean, well mixed with quartz sand and detritus of sea vegetation.

3. The mainly vegetable muds are called moors or pits, and are the end-products of an anaerob humid mouldering of marsh vegetation. This process brings about the formation of organic acids, as formic, acetic, humic, and resinous acids in the always growing pit layer.

The application of so-called mud therapy consists of:

a. Baths.
   (1) In specially built bathtubs.
   (2) In mud pools.
b. Packs.

Mud baths are given extensively in European health resorts; whereas, both mud pools and mud tubs are practicable only near the finding place of the mud, mud packs can be given any place, as the dry mud is easily transported.

To prepare a mud pack, the dry mud has to be mixed with about an equal amount of water, and heated to about 60 degrees C. It should cool down to about 45 degrees C. and have the consistency of butter. The mud pack should be administered on a massaging table or cot, provided with the following equipment: a heavy woolen blanket, a rubber sheet, and a coarse linen sheet, to be spread upon the cot in the order named. The parts to be treated, often several joints or whole limbs, should be thickly covered with the hot mud, sprayed partly on the coarse linen, partly on the treated parts. Sheets and cover should be quickly wrapped around the body, to prevent loss of heat. The patient remains one-half to one hour in the pack, which is followed by a cleansing bath and an hour's rest.

The physical properties of mud are:

1. High specific gravity.
2. Low specific heat.
3. Low heat conductivity.
4. Homogeneous dispersion of particles.
5. High plasticity, due to dispersion and colloids.

The chemical properties are:

1. Sulphates in mineral baths.
2. Chlorine in the sea muds.
3. Organic acids in the moors are the most important chemical constituents. Volcanic muds display a moderate amount of radioactivity.

Biologic Effect

The biologic effect of mud treatment is mainly due to its physical properties.

As the specific heat of the mud is much lower than that of the water, a temperature of even 50 degrees C. can be well borne in hot mud. (In plain water only about 44 degrees C.).

Due to poor heat conductivity, mud packs grow only slightly cooler during the generally protracted application. The number of calories transmitted per minute is lower than in water. Water of 33 degrees C. feels indifferent to the skin. The mud pack feels indifferent even at 38 degrees C. The heat of the mud does not invade the skin vehemently, but "sneaks" in. (Einschleichen.)

Important counter-irritation of the skin is caused by the mechanical stimulation of the quartz grains, microscopic spicules, needles, shell. The plasticity of the mud enables it to be applied to any part of the body, giving a complete heat isolation to the treated parts.

All these properties of the heated mud cause an *extreme and deep passive hyperemia,* as produced by the Bier method.

A considerable increase of the skin temperatures can be witnessed, due to stagnation in the venules. While the capillaries are opened and congested by this passive hyperemia, caused by the heat, the pressure exerted by the

heavy mud simultaneously compresses the lymph spaces and lymph vessels, evacuating their contents.

These skin effects elicit deep seated changes: 1. increase of body temperature; 2. lowering of blood pressure; and, 3. influence on mineral metabolism and blood chemistry.

The mud pack is a very effective form of conductive heat therapy, having an anodyne, absorption promoting, decongestive effect. The use of mud packs is mainly indicated in the local treatment of:

1. Chronic arthritis, irrespective of etiology.
2. Fibrositis.
3. Neuritis, sciatic syndrome.
4. After treatment of fractures.
5. Sport and industrial injuries.

An advantage of the mud treatments over electric treatments is that large surfaces, several joints, can be treated at one time, the pliable mud evenly surrounding whole limbs; an advantage over hot water baths is the higher point of indifference, which enables the patient to endure temperatures above 50 degrees C. in the mud. Members of the patient's family can be taught to apply the heated mud in the patient's house, and so reinforce the efficiency of the usual office treatments.

Both CO_2 baths and mud packs can be administered in any hospital, physical therapy institution, or physician's office, requiring only a separate room with a couch, bathtub, and a minimum of other equipment. As a large percentage of our cardiac and rheumatic patients are not able to pay the costs of a similar "cure" in expensive health resorts, it would be advisable that more American physicians use these two effective methods of therapy.

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THE RHEUMATIC PROBLEM IN GREAT BRITAIN

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The Sixth International Congress of Physical Medicine, held at London included in its program presentation of a newly inaugurated model rheumatic treatment center as well as of other new physical therapy institutions and visits to some of the health resorts specializing in the treatment of rheumatism.

The concept of rheumatic treatment centers resulted from the published reports of an investigation of the status of chronic arthritis and rheumatic conditions by the British Minister of Health[1] and by the British "approved" (sick benefit) societies. According to the classification adopted by the Chief Medical Officer of the Ministry of Health the "so-called rheumatic diseases" include such different complaints as rheumatic fever, rheumatic gout, chronic rheumatism, chronic rheumatoid arthritis, simple arthritis, fibrositis, lumbago and muscular rheumatism, brachial neuritis and sciatica, in itself an indication of the complexity of the problem.

The report of the Ministry of Health showed that nearly one-sixth of industrial invalidism is due to diseases classed as rheumatic. Each year these diseases cost the approved societies approximately $10,000,000 in sickness benefits and the nation over 3,000,000 weeks of work from the insured population alone. Rheumatoid arthritis alone cost the societies $2,000,000 a year in cash benefits. The survey also showed lack of properly equipped institutions for the treatment of insured persons and their dependents suffering from rheumatic diseases.

As a result of the survey the report proposed the following inauguration:

> Physical treatment centers which should also be arranged to act as clearing houses, directing patients as to the form of treatment particularly suited to their special needs and the place where it may be obtained. Some cases need the removal of a focus of infection, some the intensive study of an arthritis unit, others are suitable for treatment at a spa or spa hospital, whilst others would be greatly benefited by regular out-patient treatment at the centre. These centres should be organized in closest liaison with the "arthritis unit" and with the spa hospitals, and should provide the continued supervision, observation, and necessary after-care, including education in simple remedial movements, which should follow in-patient institutional treatment.

The British Red Cross Society Clinic for Rheumatism

To carry out the practical recommendations of this report the British Committee on Rheumatism, supported by the large health and trade organizations of the country, proposed to the British Red Cross Society that it should equip a demonstration clinic in London for treating workers near their homes, enabling them to continue at work while undergoing treatment. The Red Cross accepted the responsibility and the sum estimated for equipping this clinic, about $200,000, was quickly subscribed, the King and Queen and other members of the Royal Family heading the list of substantial contributions by the approved friendly and benefit societies, the leading banks and members of the Stock Exchange. The clinic was established by converting a former chapel near Regents Park, and was opened by Queen Mary on February 25th, 1930. At the time of the International Congress the clinic was ready to give comparative statistics for its first five years of work.

The clinic provides only out-patient treatment, although by courtesy of the London County Council twenty beds are allotted at one of their hospitals for in-patient treatment and investigation of patients referred from the clinic.

These cases remain under the care of the member of the medical staff of the clinic who referred them. Among the well known physical therapists on the staff are Drs. Heald, Howitt, Nissé and Ray.

Patients at the Red Cross Clinic are treated by all recognized methods — physical medicine, vaccine, immunization and the like. Special emphasis is placed on physical treatment, the following forms of which the clinic is equipped to render. In the hydrological department there are a series of deep pools at constant temperature — at 98, 100 and 102 degrees F., respectively; Aix, Vichy and Scotch douches, with massage or manipulation; local vapor baths (Berthollet), applications of hot air, fango and paraffin wax; brine, sulphur, pine and foam baths; aeration and whirlpool baths. In the electrical and radiation department there is available diathermy, galvanism, faradism, schnee baths, radiant heat and light, ultraviolet and infrared radiation. The massage staff totals to nearly sixty in number.

Regular courses of post-graduate lectures and demonstrations have been instituted under the Fellowship of Medicine, with which the clinic is affiliated, while members of the staff lecture regularly on medical hydrology to post-graduate members of the Chartered Society of Massage and Medical Gymnastics, for whom the clinic is a training school.

An interesting feature in the equipment of the clinic is the use of hydrotherapy on a large scale, and it is one of the objects of investigation to see whether this costly equipment, taking up much space, is justified. It is asserted at the clinic that many patients who have been treated by other physical methods have in many instances not improved until treatment by baths either alone or in combination with these other methods, have been instituted. Of 135,834 treatments given in 1935, 47,132 were baths; 40,465, massage; and 40,028, electrical.

The report of the five-year activities of the clinic seems to prove not only the need for this clinic but also for a considerable extension of its service. The total number of treatments in 1935 was 89,810, as compared with 77,892 in 1931. Of those patients discharged during 1935, 51 per cent were working throughout the period of their treatment, and a further 21 per cent were off work at the start but proposed to return to work when discharged — a striking testimony to the success of the clinic in attracting patients suffering from the early manifestations of rheumatism. The results of treatment of 2,314 patients discharged in 1935 with treatment completed are as follows:

Cured or free from symptoms	50.9 per cent
Definitely improved	35.1 per cent
Unchanged or only slightly improved	13.2 per cent
Worse	0.8 per cent

The financial statements show that, excluding subscriptions and donations, the clinic has worked at a yearly loss of about $17,500. The medical report makes a point of the number of patients at present attending the clinic, including many suffering from the early manifestations of rheumatoid arthritis, who would derive enormous benefit if they could be lifted out of the depression of their home surroundings and the strain of everyday life if sent to the country for a lengthy period of convalescence. It is therefore strongly felt that the equipment of a building within reasonable distance from London, of suitable aspect and elevation, which could accommodate twenty patients and the necessary staff, with grounds large enough for extension, would fully justify the expense involved.

A close parallel to the large scale application of physical measures in the British Red Cross Clinic is furnished by two other new institutions, the St. John Clinic and Institute of Physical Medicine, and the Institute of Ray Therapy.

St. John Clinic and Institute of Physical Medicine

The St. John clinic, situated at Pimlico, London S.W. 1, and founded by the British Humane Association, is conducted under the control of the Venerable Order of the Hospital of St. John of Jerusalem. It states as its objects: To bring within the reach of persons of moderate means and poor people, treatment by means of light, electricity, medical baths, inhalation, manipulation and other physical methods; for the teaching of physicians, nurses and students in the methods of physical medicine; to act as a center for consultation; and for research. Among the well known members of the staff are Sir Leonard Hill, Drs. Eidinow, Robinson and Bach.

The departments of the clinic are: Inhalation, balneological, wax bath, static electricity, x-ray, electrical, intrapelvic diathermy, orthopedic, gymnastic, general light, special light, diathermy and massage, bacteriological laboratory, vaccine department, physical laboratory and private ward.

The following are among the types of cases most frequently seen: Chronic rheumatic diseases in their varied manifestations, injuries of the locomotor apparatus, including injuries to joints, tendons, muscles and the skeletal system and the sequelae of such injuries, diseases of the cardiovascular system, including compensated heart diseases, hypertension, and the like, diseases of the respiratory tract — upper respiratory tract, e. g., sinusitis and many catarrhal affections, lower respiratory tract, e. g., chronic bronchitis, asthma, emphysema, bronchiectasis; skin diseases, including lupus, varicose ulcers; certain metabolic, gastrointestinal and nervous diseases; diseases of the endocrine system, including obesity. The clinic is becoming an important center for post-graduate teaching and research and regular courses of lectures and demonstrations are held during the year under the auspices of the Fellowship of Medicine.

Among the interesting problems of research work completed recently at the clinic are: (1) Proof that ultrashort waves of 4, 5 wavelength have no other physiologic effect than that of heat (Sir Leonard Hill and Dr. H. J. Taylor), disproving any specific biologic action; (2) study of the effect of foam baths aerated with oxygen or carbon dioxide on the tension of these gases in the subcutaneous tissues, proving that capillary stasis is not the cause of high blood pressure and that in the effect of these baths the stimulating action of carbon dioxide on the cutaneous nerves is a factor of importance (Dr. Ellman and Dr. Taylor); (3) a study by Sir Leonard Hill to prove that the air tubes of the lungs become congested and the air ways narrowed as a reflex effect of exposure of the skin to rays from dark or dull red sources of heat. When people feel a room to be stuffy, it is simply because of this effect, and is not as has been supposed, due to any change in the chemical composition of the air. This effect is at once overcome by the cooling action of a fan set to blow upon the skin. It is also controlled in about half of the subjects by rays from bright sources of heat.

The Institute of Ray Therapy

The Institute of Ray Therapy and Electrotherapy, situated at Camden Road, N. W. 1, under the patronage of Her Royal Highness, the Princess Royal, has as its object to provide all forms of ray therapy and electrotherapy to sick and poor people and those of small means, who could not otherwise afford to obtain the treatment. Among the well known members of the staff are Drs. Cumberbatch, O'Donovan and Beaumont.

The progress of the Institute and the need of such treatment are clearly shown by the number of new patients which has increased from 1,450 in 1930 to 2,244 in 1935; the number of physicians associated, from 553 in 1930 to 1,807 in 1935; and the number of treatments given, from 40,505 in 1930 to 105,387 in 1935.

The conditions treated include: Convalescence after illness and operation, general debility, conditions of workers deprived of sunlight in their work, rickets and bronchitis in children, rheumatism and rheumatoid arthritis, skin diseases, various forms of paralysis, wasting muscles due to fracture and accident.

British Health Resorts

Definite efforts have been made in recent years in Great Britain to have health resorts become a recognized part of public health service. The leading health resorts have formed a British Spa Federation, with the object of securing the highest possible efficiency in organization and treatment. Representatives of these spas meet periodically for consultation, visiting the various spas in turns. The knowledge and experience thus gained is of considerable value to all concerned. The conditions under which patients are accepted are contained in the following rule:

> In the interest of the visitors and the effective administration of the cure, it is required that medical prescriptions, not more than twelve months old, should be presented for the various treatments; and in all cases in which such prescriptions are not forthcoming, treatments are only given on the patient's own responsibility, the management reserving discretionary powers and the right to refuse enfeebled or unsuitable cases.

Droitwich Spa. — Droitwich is a little valley spa situated on the borders of England's most golden scenery. It claims to be in a class by itself in the treatment of rheumatic disorders due to the specific action of its brine baths. The Droitwich brine contains more than 30 per cent natural salt — about 10 times as strong as ordinary sea water — which is pumped up at a temperature of 45 degrees F. and is heated up by steam in order to bring it to the required temperature for the baths without any loss of its natural density. The brine is used only externally for bathing at a temperature of 90 to 104 degrees F. in full immersion bath as a rule for ten to twenty minutes. The immediate effects of this immersion are highly stimulative and tonic; at the same time the buoyancy of the brine allows muscular exercise while the weight of the body is reduced by the specific gravity of the water. Baths are also used in the aerated form, as douche sprays and douche massage, all with the object of promoting absorption of fibrotic nodules and giving gradual relief to arthritic and myositic conditions. The best response to this form of treatment is shown in periarticular changes of fibrositic character.

For general tonic treatment there are also available large brine swimming baths, kept at a temperature of 90-92 degrees F., in which the buoyancy of the brine allows exercise to improve muscular tone or increase the range of movement by even weak patients. There is excellent laboratory and general physical therapy service connected with the baths. The medical staff includes clinicians of wide repute.

Leamington Spa is an attractive town situated in the heart of the Shakespeare country of Warwickshire. Its waters are natural saline, which are used for both drinking and bathing. Their internal action is diuretic and laxative, while externally, in the form of baths and douches, they exert a markedly stimulating action and tend to promote the absorption of inflammatory exudates and adhesions. The Royal Pump Room Establishment, a large modern structure, situated in the midst of beautiful gardens, offers every modern type of balneologic, electrical and accessory treatment for rheumatism, gout, sciatica and kindred troubles. It contains also two large swimming and elaborate Turkish baths. There is an abundance of music, recreation and attractions of civic or historic interest, which explains the popularity of its "cure."

(Concluded on page 656)

NOTES ON BACKSCATTER IN X-RAY CALIBRATION

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AND

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Many radiologists throughout the country are calibrating their deep and superficial x-ray machines with their own r-meters. Others are having their x-ray output checked at regular intervals by a physicist. Both are faced with the problem of whether they should state their dose in "air" or "with backscatter." Most roentgenologists have definite views of their own on this subject and believe their particular way to be the only correct one. This paper is not intended definitely to settle this problem, but rather to point out the facts on both sides and attempt to show in which cases one method is superior to the other.

The "air" output of a given x-ray apparatus is obtained by placing the diaphragm of a standard air chamber or a thimble chamber at an accurately measured distance from the target of the tube, and by removing to a safe distance (over three feet) all solid objects such as treatment tables, cushions, and the like, which would "reflect" or scatter the direct radiation. The reading is then taken in roentgens per minute for each filter which is to be used.

A calibration of this type is valuable because it can be compared directly with the quantitative output of any other apparatus. Since it is not measured on the body, no mention of anatomic location or size of field is necessary. The intensity at any other distance that might ordinarily be used for treatment can also be easily calculated by means of the inverse square law.

However, the dose which a patient's skin would receive if placed at a like distance from the tube is not the same as the dose measured in air. When an absorbing medium, such as the human body, is placed in the x-ray beam, a portion of the radiation passes completely through, other portions are absorbed at each layer, and still others are scattered from each layer.

The mechanism of this scattering may be thought of as follows: A quantum of the radiation has a certain momentum and may strike a particle of matter in such a way as to produce only a slight deviation of the original path of the quantum (change in direction) and only a very small change in its momentum (change in wavelength). It may also be deflected through angles of ninety degrees or wider which would send it back in the general direction of the tube, and this process is known as backscattering. It can be seen that the greater the original momentum of the quantum, the smaller the probability of its being reversed. This accounts for the greater backscattering at lower voltages or longer wavelengths as the quanta of such radiation have less momentum.[1-2]

The radiation falling on the skin can be seen to have two components, namely, the direct radiation from the target and the scattered radiation from the tissues below. The total amount it receives depends therefore, on the intensity of the direct radiation (as measured in "air") and the scattered radiation from below, which is at a longer wavelength and has an intensity

which depends on the area of the field treated, and on the volume and type of tissue below the surface. It also depends on the quality or penetrating power of the direct beam.

The size of the field and the volume and type of tissue have an effect on the skin dose, because any point on the skin receives radiation which was scattered from all points beneath it. The quality plays a part by determining the intensity of the radiation at the points below the skin from which it is scattered back, and determines the difference in "momentum" as pointed out.

Measurement of Skin Dosage

The question arises as to just how the skin dose should be measured. In making the conventional depth dose and backscatter curves, different laboratories use different methods of obtaining the intensity at the surface. Some place the ionization chamber on the surface of the absorbing medium, others use it in a half submerged position and still others completely submerge it. This will, of course, affect the intensity at zero depth and therefore the position of the various "isodose" lines, because these show the percentage of the intensity at zero depth which is present at any point below the surface.

The completely submerged and the half-submerged measurements are probably closer to the correct value on the skin, but naturally cannot be employed directly on a patient. The difference between these values and those obtained by placing the chamber on top of the skin is less than would be expected, because, as the chamber is brought up from the submerged position to the surface, the decrease in backscatter is compensated for by the increase in the direct ray, due to the chamber coming closer to the tube.

In practice, the skin dose may be obtained in two ways. First, by the use of a curve such as shown in figure 1, which is made on rice with the

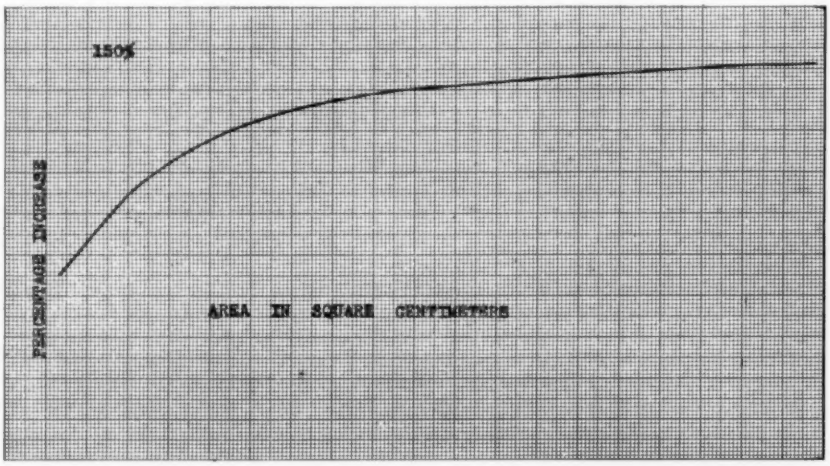

Fig. 1. — Curve showing relation between measurements made in "air" and with "Backscatter."

ionization chamber half submerged. Rice may be used as it has approximately the same absorption and scattering characteristics as tissue. From this curve and a knowledge of the intensity in "air," the skin dose for any size of field may be calculated very simply. Second, the skin dose may be found by placing a small ionization chamber directly on the skin at the time of treatment.

If the dose is measured by the first method, that is, in "air," it will be subject to the following errors:

1. Errors in the measurement of the skin-target distance.
2. Errors in the measurement of the size of the field.
3. Errors due to unusual or accidental changes in the x-ray output, such as rectifier trouble or accidental use of wrong filters.
4. Errors in the backscatter curve, since the backscattering may be different on the chest, abdomen or legs. The curve represents only the mean value of these different locations.

The errors to which the second or "with backscatter" method will be subjected are:

1. Errors due to the chamber not being independent of wavelength since part of the scattered rays are very "soft."
2. Errors due to the chamber not being half submerged.
3. Errors due to the chamber not being tight against the skin.
4. This method is also subject to Errors No. 1, 2, 3 of the first method unless a measurement is taken for each treatment, in which case these errors are not applicable.

A study of these errors has led the authors to believe that the first is more accurate when only occasional measurements are employed, but when a measurement is made at each treatment, then by far the safer and more accurate results are obtained with the second method.

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IONTOPHORESIS IN RHEUMATOID ARTHRITIS *

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Iontophoresis, which is the introduction of ions into the body for therapeutic purposes by an electric current, has been advocated as a method of treatment for chronic arthritis by Kovács.[1] The rationale of this method lies in the fact that choline compounds are known to relieve vascular spasm and promote a more active circulation. So far as arthritis is concerned, it has seemed reasonable to suppose that improvement might follow locally about the joints by reason of the prolonged action of the ionized drugs.

The choline derivative we have used is acetyl-beta-methylcholin chlorid,** which is the same substance employed by Kovács, whose technic we have followed. Treatments were given twice a week for the first month, and once a week thereafter. Dilutions varying from 1:200 to 1:500 were used. It was found that the higher dilutions were less uncomfortable for the patients, and the lower concentrations were avoided. The positive pole of a galvanic generator was placed over the joint to be treated, the joint having first been wrapped with asbestos paper soaked in the solution, over which was placed a sheet of lead foil. A large padded sheet of lead foil

* From the Robert B. Brigham Hospital, Boston.
** The drug used was supplied by Merck & Co.

TABLE 1.—*Details of Treatment by Iontophoresis on Twenty Patients With Rheumatoid Arthritis*

Patient	Sex	Age	Duration of Disease	Number of Treatments	Duration of Treatments In Minutes	Current In Milliamperes	Dilution of Drug Aqueous	Joints Treated	Degree of Involvement	Reaction	Improvement
1	M	16	10 mos.	18	20	25	1-250	knees	severe	less pain and stiffness temporarily	no
2	F	41	18 mos.	17	20	15	1-250	hands	severe	redness and sweating for 6 hours; palpitation and flushing	yes
3	F	13	2 yrs.	9	20	15	1-250	hands	mild	none except usual pin and needle sensation	no
4	F	59	14 yrs.	9	20	10	1-200	knees-hips	moderate	redness and sweating for one hour	no
5	F	50	10 mos.	9	20	10	1-250	knees	moderate	redness only	no
6	M	59	1 yr.	7	20	20	1-250	feet	moderate	redness; slight sweating	no
7	M	38	2 yrs.	6	20	30	1-500	knees	severe	redness and sweating; treatment uncomfortable	no
8	M	39	7 yrs.	5	20	30	1-200	hands	moderate	sweating only	no
9	M	40	5 yrs.	5	20	30	1-250	knees	severe	negligible	no
10	F	26	3 yrs.	5	20	30	1-200	knees	severe	marked redness and sweating; no relief from pain; treatment omitted by request	no
11	F	40	6 yrs.	5	20	15	1-200	hands	severe	pain definitely relieved; motion increased; no unfavorable reaction	yes
12	F	44	17 yrs.	4	20	10	1-500	knees-hips	moderate	flushing; headache; nausea; no improvement	no
13	M	28	6 yrs.	4	20	30	1-200	hands	severe	temporary relief from pain	slight
14	F	61	6 yrs.	4	20	30	1-200	knees	mild	redness, sweating, temporary relief but severe rash and itching	slight
15	M	48	7 yrs.	4	20	20	1-500	knees	mild	temporary warmth	slight
16	M	38	1 yr.	3	20	30	1-200	knees	severe	uncomfortable sensation; did not want treatment continued	no
17	M	26	8 mos.	3	20	30	1-500	knees	moderate	indifferent	no
18	F	44	2 yrs.	2	20	20	1-250	knees	moderate	marked redness and sweating, but no appreciable change	no
19	F	37	18 yrs.	2	20	30	1-200	hands	moderate	itching and burning sensation; did not like treatment	no
20	F	39	9 mos.	2	20	30	1-500	knees	moderate	temporary warmth and redness; no change in symptoms	no

connected to the negative pole was placed under the patient's back. The dosage varied from 5 to 30 ma., the duration in all cases being twenty minutes.

Twenty patients received a total of 103 treatments. All of these patients were suffering from rheumatoid arthritis; details as to the duration of the disease, joints treated, may be noted in the accompanying table.

No severe reactions were encountered. All of the patients experienced a sensation of "pins and needles" about the joint when the current was on, and 14 of them noted a feeling of warmth. Blood pressure changes were not great, except in one case where a drop of thirty points was recorded. Nine of the patients showed redness about the treated areas lasting two or three hours, and an equal number of patients noted sweating which continued four or five hours. Three subjects had mild attacks of headache, palpitation, breathlessness lasting for one hour following treatment, but these were not of a serious nature.

But two patients in our series reported relief of symptoms, which is in marked contrast to Kovács' figures of 95 per cent improvement in a group of sixteen rheumatoid arthritics. After six months' experience with iontophoresis, we desided to discontinue it as a form of therapy as being of little, if any, value in the treatment of rheumatoid arthritis.

Six of the patients in the series under consideration had experience with under-water exercises in the Hubbard tank, and they emphatically stated

that the under-water therapy was far more effective in relieving their joint symptoms and increasing their joint motion than iontophoresis. The majority of our patients were unable to report any beneficial change, even for a short time. The treatments by iontophoresis are time-consuming, require special apparatus, are frequently unpleasant to take, and our experience, though not extensive, leads us to believe that it has little, if anything, to offer patients suffering from arthritis.

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RECENT ADVANCES IN SHORT WAVE DIATHERMY *

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The usual application of short wave diathermy for general as well as local treatment is executed with condenser-plate-electrodes of different sizes, and separated by an air-space from the body surface. This spacing is performed by holding the plates either on a stand at a certain distance varying between one-half and two inches, or by providing air-space through the interposition of felt layers or an empty glass vessel.

In all these cases the electric field is very indefinite. The lines of force irradiating from the central parts of the electrodes enter the body surface rather perpendicularly, but those lines originating from the intermediate parts and from the edges of the electrode-plates tend to diverge considerably, the outer ones traveling for a distance nearly parallel to the body surface. Accordingly the density changes considerably throughout the whole area of the irradiated surface of the body. Furthermore, the effect becomes more unequal as the surface is never level and prominent parts of it tend to attract a greater amount of energy, even producing point effects like the nose, the edge of the ear, or the chin. The field does not extend only on the side of the electrode-plates facing each other but the edges, the posterior sides and the leads radiate the more the wider the air spaces.

Considering the loss by leakage to the ground through the support of the electrodes, the patient, neighboring objects and persons, and the above described circumstances there results a dissipation of energy so that the part to be treated may be estimated to receive only about twenty or thirty per cent of the energy produced.

These conditions render exact localization very difficult. If for example we apply an electrode of four by five inches surface at one inch distance to a nasal sinus, we have only a very remote possibility of directing the energy to it. A greater part will possibly reach the prominent parts like the nose, the region of the eyebrows, the zygomatic bone, and if the patient is fat, the prominent part of the cheek, apart from the general losses which we just mentioned. The same holds true for other local applications, for instance in the axilla, to the neck under the chin, to the mastoid behind the ear and other parts of the body.

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 9, 1935.

I have aimed at overcoming these difficulties by studying the distribution of the field and its alterations by introducing different materials, animals, or body parts into the field, by changing the positions, relative sizes, forms and materials of electrodes. After hundreds of experiments I succeeded in developing the following system which practically removes all the difficulties of local treatment by short waves.

A dielectric of a higher constant than air acts on electric lines of force like a piece of soft iron on magnetic lines of force. Introduced into the field, such a dielectric attracts and collects lines of force, conducts them and if in contact with the metal surface of the electrode practically eliminates the radiation by its strong damping effect. This field or current concentration offers an ideal possibility of localization by replacing the air space through suitably formed dielectric electrodes of proper material.[1, 2, 3] Such electrodes give quite good results from the standpoint of exact localization and are good for central deep effects, but the conduction is inadequate. I have, therefore, prepared mixtures of finely divided metallic, non-magnetic substances with suitable dielectrics. If these mixtures are carefully executed, the resultant material should represent a vast number of small single metallic centers, each one surrounded by a very thin layer of dielectric substance. The whole represents a multitude of small condensers arranged partly in series, partly in parallel. The distance between such adjacent condensers being exceedingly small, the potential drop between neighboring condensers is very small, too. Yet, by shaping this material to electrodes of some length considerable voltage drops between the two limiting surfaces can be produced. Such material is free from self-induction, and if the dielectric material is well selected the electrode does not heat up and conducts with relatively little loss. The ohmic resistance for direct current is, of course, very high, but as high frequency currents especially of very short wavelength are able to cover it as displacement currents, such a series of small condensers represent a very good conductor.

Experiments have shown that the localizing effect is perfect. We can produce a localized area of coagulation in a piece of meat where we want it and the form of the coagulation area corresponds exactly to the form and shape of the applied electrode surface. The lines of force emanate from the surface, reach the body perpendicularly, and the full energy carried by the electrode applies to the part with which it is in contact. There is no danger of heating adjacent prominent parts as the electrode does not radiate.

Advantages

The advantage of concentrating practically the whole energy delivered through the electrode renders treatment very economical. With a medium sized electrode short wave apparatus of usual size which deliver about 300 watts, have to be regulated almost to their minimum output. As the losses are reduced to the minimum this smallest output suffices for the production of a very intense local heating. This means that by applying this new system of local treatment we may employ even small and inexpensive portable apparatus. Experiments have shown that spark-gap are just as suitable as tube apparatus. While it is true that specificity of wavelengths play a rôle in non-living material, we have clinically no tangible demonstration of it in the complicated living body. Any differences may be explained by differences in intensity, as we are not in possession of any reliable measuring device, and even if we were, we have to consider the quantum energy content of the wave itself, which differs for every wavelength ($h\nu$).

The advantages of this new system of short wave electrode application are obvious:

1. Reduction of leakage and radiation by the damping effect to a minimum.

2. Complete and strict field localization.
3. Efficient current concentration.
4. Even a weak short wave apparatus permits of sufficient energy application for any local purpose. There is no difference in the efficiency between spark-gap and tube apparatus.
5. Clinically any short wavelength between two and fifteen meters applied with these electrodes has proved equally efficient.
6. Like with conventional diathermy the degree of deep effect is largely dependent on dosage. The same rule is valid: Strong currents applied for a short period have more pronounced superficial effects, while lower intensities applied for a long time produce deeper effects. Too low intensities produce no measurable temperature elevation, as the cooling mechanism of the organism, especially the blood and lymph flow, dissipate any local temperature elevation.

This new device, therefore, enables us to apply strictly localized short wave treatments. We can rely upon the whole output of the apparatus to the treated area because the energy is not dissipated, which facilitates a more exact dosage. The fact that no energy diverges to adjacent prominent parts, if they are maintained without direct contact with the electrode, is a further advantage.

Altogether this new device combines a simple and much more economical use of high frequency with a considerably higher possibility of localization and safety.

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LOCAL HEAT TREATMENT IN OZENA

Preliminary Report

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Ozena, the cause of which is still unknown, is an atrophy not alone of the nasal mucosa and underlying tissues, but of the osseous turbinates as well. It is clinically progressive, attacking first the epithelium of the nasal mucosa. Atrophy of the epithelium is followed by the loss of the cilia, degeneration of the mucous glands, and diminuation of the vascularity of all the nasal tissues. The vascular changes interfere with the trophic functions of the tissues which in turn set up a vicious cycle resulting in the well known and abhorrent symptoms of ozena.

The treatment of ozena can be either conservative or radical. The radical operative procedure, consisting in narrowing the nasal fossae, produces its effect not by physiologic processes but by mechanical ones. It is usually done where the ozena is advanced, and where the conservative methods of therapy have had little or no appreciable influence on the course of the disease.

The conservative treatment is legion. Basically, it is nasal hygiene. Foremost and most effective is the nasal douche to soften the crusts and mechanically remove both the crusts and thick nasal secretions. Oil sprays

and some stimulating medication to the nasal mucosa supplement hygienic therapy. From this point the individual preference of the physician determines whether vaccines, nasal packing, ionization or any one of the numerous other treatments are to be used. All these methods when vigorously applied may control the obnoxious clinical symptoms, and often the patient remains symptom free both while under treatment and for some time after discontinuance of therapy. It is not within our province to offer a specific therapy for ozena, but from a physiologic viewpoint the method of treatment to be presented is theoretically reasonable, and clinically it has produced good results.

Essentially it is the physiologic effect of the direct application of heat to a large surface of the nasal mucous membrane for prolonged periods of time. The direct heating of the nasal mucous membrane produces such well known circulatory and trophic phenomena that we may restrict ourselves to a description of the technic.

Fig. 1.—A lateral x-ray shadow of the right nasal mucosa showing the extent of contact established by means of a rubber applicator filled with barium.

The accompanying x-ray (fig. 1) is a lateral view of the head. Into the right nasal fossa has been inserted a rubber applicator of special design and shape, which has been filled with barium for roentgenographic purpose. It will be seen that the shadow extends the entire length of the inferior meatus back to the posterior nasopharynx. Furthermore, it extends upwards beyond the level of the middle turbinate. On inflation it establishes contact with both the medial and lateral walls of the nose. In no treatment to our knowledge has there been established such an extent of contact. If instead of barium the applicator be filled with a heated solution from an Elliott apparatus we will have a heat effect by direct contact over the entire area shown in the roentgenograph. The light areas in this and the other roentgenograph to be shown are caused by air bubbles which we were unable to exclude from the applicator. In the clinical application suc-

Fig. 2. — Application in adjustment to the floor of the nose by its ballooning through hydrostatic pressure.

tion is first applied which collapses the applicator by vacuum action and facilitates complete filling of the applicator with a solution only. We call this type a positional applicator, because while the applicator swells under fluid pressure, its shape does not materially change, and its position in the nasal fossa once inserted remains constant.

The illustration shown in figure 2 reveals the position in the nasal fossa of the ballooning type of applicator. This applicator is made of very thin but strong rubber and when inserted into the nose has the appearance and thinness of a jack knife blade. It has no shape, but conforms by its ballooning action to the space in which it is confined. The adaptation of the applicator to the floor of the nose is noteworthy. Particularly significant is that the ballooning out of the applicator establishes contact in the areas of the Eustachian tube, sphenoid sinus, and posterior ethmoidal cells. The clinical significance of the ability to establish direct heat contacts in these otherwise inaccessible areas is evident. In our experiments with short and ultrashort waves using apparatus of 500 watt output, local treatment to the head did not exceed temperatures of 102 degrees F. Temperatures in the sphenoidal and ethmoidal regions have been even less owing to radiation losses through the inspired air. Since the temperature of the solution circulated through the applicator is elevated to 125 degrees F., we are certain to obtain a local temperature much higher than with short waves.

To date we have treated 4 cases of ozena showing the classic signs and symptoms of atrophy, crusts, and fetor. Within a week the crusts became reduced, the odor disappeared and the patients were markedly improved. It is, of course, possible that these patients with conventional hygienic care would also have shown definite improvement. Our results, however, were achieved not by nasal irrigations but by the physiologic reactions of the diseased tissues to the local application of heat.

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X-Ray and Radium — HARRY H. BOWING, M.D., *Rochester, Minn.;* R. W. FOUTS, M.D., *Omaha;* R. E. FRICKE, M.D., *Rochester, Minn.;* IRA I. KAPLAN, M.D., *New York;* A. F. TYLER, M.D., *Omaha.*

Biophysics — ALBERT BACHEM, Ph.D., *Chicago.*

Biochemistry and Nutrition — VICTOR E. LEVINE, Ph.D., M.D., *Omaha.*

Foreign Collaborators — OSCAR BERNHARD, M.D., *St. Moritz;* H. BORDIER, M.D., *Lyons;* ELKIN P. CUMBERBATCH, M.A., M.B., (Oxon) M.R.C.P., *London;* A. R. FRIEL, M.A., M.D., (Univ. Dub.), F.R.C.S.I., *London;* SIR HENRY GAUVAIN, M.D., M.Ch., *Alton, Eng.;* F. HOWARD HUMPHRIS, M.D., (Brux.), F.R.C.P., (Edin.), D.M.R. and E. (Camb.); MOREL KAHN, M.D., *Paris;* JOSEF KOWARSCHIK, M.D., *Vienna;* FRANZ NAGELSCHMIDT, M.D., *London;* A. ROLLIER, M.D., *Leysin;* CARL SONNE, M.D., *Copenhagen;* ALBERT E. STEIN, M.D., *Wiesbaden.*

EDITORIALS

PHYSICAL METHODS IN PERIPHERAL CIRCULATORY DISEASES

One of the reproaches made against scientific medicine is that it has manifested periodic trends to accept therapeutic methods as of great importance when in a comparatively short time they were discarded as of little or no value. This was particularly the case a few decades ago, a situation which created a spirit of conservatism or rather scepticism in the medical profession. At this time the treatment by passive vascular exercise in which controllable environmental pressure of peripheral blood vessels is introduced is attracting considerable attention. It is not coincidental that essentially this procedure has been in use many years only to be relegated to the limbo of speculative therapy. It was due to the genius of August Bier[1] that the production of mixed hyperemia in extremities by a modification of an ancient concept was given a rational basis. At that the general profession failed to appreciate the importance of the method and again sought panaceas in other directions.

It has been well argued that the genius must be born into a receptive period of society in order that his talents be recognized; and so too is this true for the newer innovations in medicine. History has recorded the many attempts of introducing a mechanical means of preventing the serious sequellae of obliterative arterial diseases of the extremities by stimulating the collateral arterial pathways only to result in failure. These failures are ascribable as much to the fact that the seed was nourished in a soil of misunderstanding and ignorance as to the circumstance that it was conceived at a time when our mechanical orientation was at low ebb. Thus it was that the same concept repeatedly sought medical recognition and was shelved for more appealing and less successful methods. Today the memory of these pioneers has been revived and they are given belated honor because

of the growing consciousness of the profession relative to their studies of the physiologic effect of controlled atmospheric environmental pressure for the relief of vascular obliterative diseases. In the main the basic ideas[2] proposed by George Conrad Stahl, in 1694; by Nathan Smith, in 1798; by Ralph Bleg-borough, in 1803; by Sir James Murray, in 1812; by Victor Theodore Junod, in 1833; and by Clanny, Bluck, Bier, Klapp, Bibard, and others are today incorporated into the various types of apparatus for controllable passive vascular exercise of the extremities.

The changes introduced into the modern "boot" are essentially those which provide not only greater mechanical efficiency but which include certain provisions for sustained comfort and deeper reactivity of the vasospastic and partly obliterated vessels. It soon was found that while the old procedure was correct in principle, it was faulty in execution. Diminished or increased environmental pressure for its beneficial effect required rhythmic control as well as positive and negative phasic changes of a definite character. In order to bring about the greatest beneficial changes in the arterial circulation with the least damage to the tissues, the collateral arterial pathways and the tissues within the field were found most improved when subjected to gradual and cyclic pressure of the muscular tissues. Under such a regime Hermann and Reid[3] demonstrated by clinical and experimental studies that pain could be relieved; that an adequate circulation could be re-established through the collateral pathways and infection in poorly nourished tissues could be prevented. It must, however, be pointed out that while notable improvement took place under the physical influence of rhythmic negative and positive pressure alone, it was not until the heat reflex observation of Landis[4] was introduced into this therapy that consistent clinical results were recorded. Landis pointed out that the immersion of the forearm in heated water produced a concomitant vasodilatation in the lower extremities, a fact which is now utilized to enhance the mechanical therapy of peripheral circulatory diseases. Critically reviewing the combined and independent effects of each, Theis and Freeland[5] in their own recent studies point out that the accrued benefits are greater than when singly applied. They say in part:

> Vasodilatation as a result of direct heat or reflex heat is more effective in increasing peripheral circulation but appartently has little effect in augmenting oxygen-carbon dioxide exchange in the tissues. The increased circulation merely increases the adequate oxygen supply that is still available.
>
> Combining reflex vasodilatation with pressure treatment, our routine procedure is of distinctly more clinical value than either measure alone. The reflex vasodilatation produces maximum increase in circulation and the pressure treatments augment local tissue metabolism. The resulting greater utilization of increased oxygen supply seems to be the basis for the superiority of the form of combined treatment.

While undoubtedly passive vascular exercise has demonstrated its clinical value in vasospastic conditions, its future position in therapy may be predicated on its distinct promotion of a definite train of physiologic changes produced on the tissues directly and even distantly within its influence. Its far reaching possibilities can be readily appreciated because its influence is not limited to the collateral arteries, but perhaps primarily affecting the autonomic nervous system. While it may be debatable whether it could influence vasospasms of central origin, Sir Thomas Lewis has demonstrated that there are varieties of vascular spasms of peripheral origin in which pressure therapy plays a beneficial role. Then too there are inflammatory derangements other than circulatory in nature wherein it is essential that the circulation and the metabolic tempo be raised to a more active level as in chronic arthritis, myositis, non-surgical affections of the deeper viscera,

open and indolent wounds, gangrene, and the like. Equally important to the amelioration of the many affections suggesting medical supervision by this method is the necessity of finding out its limitation, for scientific practice avails itself of organized knowledge. The general expression of its value undoubtedly carries that much desired note of conservatism combined with a feeling of optimism. What is still needed in this field of study is best expressed by Frazer in the *Golden Bough* — "In reviewing the opinions and practices of other ages and generations, we shall do well to look upon their errors as inevitable slips made in the search for truth, and to give them the benefits of that indulgence which we ourselves will one day stand in need of."

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PHYSICAL THERAPY IN GYNECOLOGY

Inquiry among representative groups of gynecologists reveals that the usefulness of physical agents in the management of certain gynecic conditions is not fully appreciated. Under the circumstances many patients are deprived of the benefits of physical therapy and correspondingly many gynecologists and practitioners the tangible and intangible satisfaction that should be theirs instead of irregulars and quacks. For it is indisputable that women displeased with the results of non-surgical treatment of their ills, eventually seek out men with the loudest voices and the weakest talents. The inquiry has shown that both gynecologists and practitioners interested in physical medicine have somehow reached the conviction that lacking space and equipment they cannot compete with modern sanatoria or similar installations. It is not denied that physical therapy presupposes utilization of at least some apparatus and some office space, but this objection is not a valid one when one takes into consideration the return in therapeutic results, prestige and the corollary of larger earnings.

Just as internists can no longer practice successfully with merely a prescription pad and a fountain pen, so one can no longer succeed in the treatment of many diseases of women with tampons, the application of iodine to the uterine mucosa, or the advice to take hot vaginal douches. We are forced to the conclusion that the widespread indifference to the employment of physical therapy in gynecology is not ascribable solely to a disinclination to secure equipment, but in part at least to the narrow concept that most if not all affections of women are localized organic lesions of the genital apparatus. It would almost seem that many visualize sick women as human beings surrounding a uterus and adnexa. That this charge is not without justification is clearly evidenced by the records of very many physicians. One seldom finds notes about hygienic advice, or that dietetic restrictions have been ordered. More rarely does one learn that rest, exercise, massage,

and baths have even been thought of in the management of many chronic gynecic conditions. Although balneotherapy can be easily carried out in patients' homes equipped with modern plumbing, the art of making use of baths for therapeutic purposes is a lost one. Few general practitioners and fewer gynecologists have concrete knowledge of the physiologic effects of local, partial and full baths at temperatures ranging from cold to hot, including the intermediary groupings of cool, tepid, warm and the like. As for the therapeutic indications of these roughly grouped baths, they are *terra incognita,* although they should play a great rôle in the regimen of somatic conditions so prevalent among women.

Electricity was for a while popularized by Apostoli, in France, and Massey, in the United States, as an agent suitable in the management of uterine neoplasms, but the methods of these pioneers could not long retain a foothold because surgery and radiotherapy proved far more effective. At that electricity in one form or another plays today a very important rôle especially in infectious and inflammatory affections of the female genitals. The advent of short wave diathermy has opened a wide field of application for radiatherapy in gynecology. We may ignore here the so-called hyperpyrexia treatment of gonococcal infections as perhaps being better left in the hands of specially trained and equipped physical therapists, but even in this type of infection excellent results may be obtained from topical short wave diathermy. An efficient short wave apparatus can now be had in sufficiently compact form to occupy no more space than an ordinary dressing stand. Where even that little space is not available a shelf fastened to a wall in the consultation or treatment room of one's office will prove adequate. The necessity for a short wave apparatus will become clear from a careful perusal of Schliephake's[1] reports, which show that many cases that have heretofore been considered as purely surgical in character may be more effectively cured by conservative radiathermy.

The surgical applicability of the high frequency currents, too, has increased the range of electricity in gynecologic therapy. By this we do not imply major operations carried out with the aid of the cutting or coagulating current, for in the main they do not greatly differ from classic operations, but we have reference to procedures which can be undertaken in one's office. Roblee[2] has clearly shown on a large material the effectiveness of minor electrosurgical procedures in certain types of cervicitis, while Ground[3] combines a similar procedure with ionization for the control of cervical and uterine infections in a chronic stage. Even if the measures merely relieve the patients of leucorrhea, metrorrhagia and certain reflex symptoms (backache), and complete restitution of the lesions is not attained, the method recommended by Ground should find widespread employment. Of course, this requires resort to the galvanic current, but the equipment involves no great outlay and the technic is not difficult to acquire. There is much of informative material in the contemporaneous specialistic literature to serve as a guide to the indications, physiologic action and therapeutic technic of the physical agents to which we have drawn attention.

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SCIENCE, NEWS, COMMENTS

Annual Session of Academy of Physical Medicine

The American Academy of Physical Medicine will hold its annual meeting in Boston, Massachusetts, at the Hotel Statler on October 20 to 22, 1936. The conference will include an educational report under the chairmanship of Dr. R. Tait McKenzie of Philadedphia; a symposium on fever therapy led by Dr. Frank H. Krusen of Rochester, Minnesota; a dermatologic symposium under the chairmanship of Dr. Francis P. McCarthy of Boston; and a symposium on electrosurgery conducted by Dr. Benedict F. Boland which will present the progress in this field from every practical situation. Listed below are a few of the important papers to be presented at the above session:

Dr. Frank Hammond Krusen, Mayo Clinic, Rochester, Minn., Presidential address: The Present Status of Physical Therapy.
Dr. Stafford L. Warren, Strong Memorial Hospital, Rochester, New York, Arthur H. Ring Foundation Lecture: Treatment of Gonococcal Infections by Artificial Fever Therapy.
Dr. E. Leon Chaffee, Ph.D., Harvard University, Physics and Biology of Physical Medicine.
L. L. Campbell, Ph.D., Simmons College, The Radiation Energy of the Electromagnetic Spectrum.

Detailed information regarding this splendid program and the meeting may be obtained from its secretary, Dr. Franklin P. Lowry, 313 Washington Street, Newton, Mass.

Rickets May Have Ruined First New World Colony

The New World, discovered and colonized by Europe five hundred years before Columbus, was lost again because of rickets, modern archaeological excavations in Greenland suggest.

At Herjolfsnes, on the lonely Greenland coast, several skeletons of Viking women, disinterred and studied by Prof. F. C. C. Hansen of Copenhagen, exhibit severe pelvic deformations. The abnormalities are due to osteomalacia, (rickets in its severe form), according to Dr. J. Preston Maxwell, British physician and professor of gynecology at the Union Medical College at Peiping, China. By inhibiting reproduction among the settlers, this disease changed the course of history, Dr. Maxwell suggests.

The Greenland colony was founded in 985 A.D., by Eric the Red. It was Eric's son, Leif the Lucky, who discovered "Vinland," thought to have been perhaps Massachusetts.

The Greenland settlements lasted five centuries. An independent state at first, they finally became a Norse colony. Scandinavian ships maintained a busy commerce there, trading European wares for New World walrus ivory. Great stone churches were erected; cattle were imported; and new local industry began.

Clothing styles dug up by archaeologists in Herjolfsnes show how close and continuous the European contact was for a while. Then, at last, for some mysterious cause, decline set in. The population died. Houses fell into ruin. Grass and willow grew over them. Finally Eskimos settled at the sites. The Norse ships stopped coming, no one knows when, or why. — *Science News Letter.*

Abandoned Drug Is Antidote for Sleeping Powder Poison

An antidote for otherwise fatal poisoning from overdoses of commonly used luminal, veronal and related sleeping powders has been found in picrotoxin, a drug formerly much in vogue but little used in recent years.

Two human cases in which the new treatment proved its worth and animal experiments leading to its use were reported by Drs. T. Koppanyi, J. M. Dille and C. R. Lingar, Georgetown University Medical School, to the American Association for the Advancement of Science.

Physicians will soon be able to use this new treatment in rescuing from death those who inadvertently or with suicidal intent take large doses of the barbiturate sleeping powders.

The patients on whom the new antidote was first used were both elderly persons, a man and a woman, patients of Georgetown physicians, Drs. Wm. S. Murphy and Connolly. The woman had taken luminal, the man amytal, both in very large doses, and both patients were absolutely paralyzed from the overdose of sleeping powder. The woman responded very favorably to picrotoxin, Dr. Koppanyi reported. She came out of collapse, began to move, eat, drink and even to talk, though not coherently. Unfortunately, she died of lung infections which had set in before the picrotoxin treatment had been started. Blood tests, however, showed that the amount of luminal in her body was progressively decreasing in relation to the improvement in symptoms noted following the picrotoxin treatment.

The man was fortunately seen very soon after he had taken the overdose of amytal. Picrotoxin treatment was started immediately and continued for two days. The patient progressively improved and after a final fairly large dose of picrotoxin suddenly showed what Dr. Koppanyi calls the "awakening effect of picrotoxin," began to move about, asked rational questions and from then on made an uneventful and complete recovery.

Picrotoxin, the substance which promises to save victims of overdoses of modern sleeping powders, is not suitable for treating all cases of poisoning due to narcotics, Dr. Koppanyi warned. In morphine poisoning, for example, picrotoxin produces no "awakening effect" and tends to make the con-

dition of the subject worse. Before starting this treatment, the physician should find out whether the poisoning is due to sleeping powders like veronal or amytal, Dr. Koppanyi advised. This may be learned either from the history of the case or by performing the Koppanyi test for these compounds.

Picrotoxin is a bitter-tasting, white crystalline powder found in the famed fish berries of East India, where it got its name from the fact that the natives used it to poison fish. It is a powerful stimulant and formerly was an official drug in the U. S. and British Pharmacopoeias. In former times it was almost without exception put to the wrong use, Dr. Koppanyi explained, being used then to treat epilepsy and St. Vitus' dance, conditions characterized by convulsions which picrotoxin itself has a tendency to produce. It was therefore taken out of the pharmacopoeias and discarded as a useless remedy.

Merit for rescuing it from oblivion and suggesting its new use as an antidote for a certain type of poisoning belongs to Dr. A. L. Tatum and associates of the University of Wisconsin, Dr. Koppanyi declared. These investigators first showed that picrotoxin shortened the recovery time of animals poisoned by the veronal group of sleeping powders.

Dr. Kopponyi and associates showed among other things that very large doses of picrotoxin may be necessary to counteract the effect of the veronal-amytal type of sleeping powder. In very severe poisonings it is necessary to give one animal a dose of picrotoxin large enough to cause convulsions in 300 normal animals. Yet the poisoned animals are so depressed by the sleeping powder that they hardly show any twitches under these terrific doses of picrotoxin. This shows not only that picrotoxin is an effective antidote but that it is safe to use in these cases.

Even more dramatic than its life-saving effect is the "awakening effect" of picrotoxin, Dr. Koppanyi said. At the meeting, he showed moving pictures of animals to demonstrate this. These animals were poisoned not by very large doses of the sleeping powders, but had had enough to produce deep sleep and unconsciousness. They were lying perfectly helpless on the floor. When moderate doses of picrotoxin were injected they suddenly awoke and began to move about in lively fashion.

Tests also showed that picrotoxin in some cases actually increases the rate at which amytal and similar sleeping powders are destroyed in the body. — *Science News Letter.*

Find New Form of TB "Germ" in Breeding Experiments

Artificial breeding experiments with the tuberculosis "germ" which resulted in the discovery of a new form of this bacillus and shed fresh light on the disease were reported to the Society of American Bacteriologists by Drs. Ralph R. Mellon, Philip J. Almaden and Ruth D. Richardson of the Western Pennsylvania Hospital's Institute of Pathology, Pittsburgh. Dr. Mellon is also director of the medical research affiliate of the Mellon Institute, which sponsored this work.

The new organism produces in experimental animals a kind of reaction not produced by conventional forms of the tubercle bacillus. This kind of reaction is known technically as noncaseating, meaning that the tissue is not killed en masse by the infection. Since this tissue-killing is one characteristic of the disease, its absence has made diagnosis difficult and uncertain in some cases, Dr. Mellon explained.

"Preliminary studies already conducted in suitable patients have illuminated these uncertainties for the first time," he said, "and to an extent that gives promise of still wider application of this knowledge."

Another of the unique and important characteristics of the new bacillus is the fact that it is either non-pathogenic or produces a benign form of the disease in highly susceptible animals. This suggests that in part, at least, resistance to tuberculosis may be acquired by people as a result of infection with the newly-discovered organism rather than from repeated infection with small amounts of the usual disease-producing form, as has been previously supposed.

The breeding of this new tuberculosis "germ" may aid diagnosis of the disease in still another way, it appears from the report of the Pittsburgh investigators. This new organism can produce a tuberculin that is different from the tuberculin produced by the human, bovine or avian bacillus. Tuberculin is a chemical product of the tuberculosis "germ" specific for this organism and used for diagnosis of the disease.

"It becomes distinctly possible that patients reacting to the new type of tuberculin still have a form of tuberculosis not detectable perhaps with the old type," Dr. Mellon said. — *Science News Letter.*

Lead Helpful Addition to Treatment of Cancer

Injections of lead compound are helpful in conjunction with surgery in the treatment of cancer, Drs. J. Arnold Bargen, Bayard T. Horton and Arnold E. Osterberg of the Mayo Clinic reported to the American Journal of Cancer.

This does not mean that lead is a cure for cancer. But when the size, extent and situation of the cancer make its complete removal impossible, intravenous injection of lead seems to do something to the body processes that tends toward suppression of the remaining cancer cells, the Mayo Clinic investigators report.

So far they have worked only with far advanced, hopeless cases of cancer. They believe their results justify further experimentation and trial. Two phases of the problem need further investigation. One is the problem of the best way to get lead distributed from the point of injection to the cancer tissue. The other is the question of hindering the growth of a cancer by a substance that affects fundamental body processes known by the scientific term of metabolism. — *Science News Letter.*

America's Scientists Are Tall, Dark, Deep-Chested

A "typical" leading scientist in the United States would be taller and deeper-chested than the average person. He would be dark-haired (or dark, turned to gray) and his head would be larger and proportionately broader than the average American's. Though getting well along in years he would not show any notable signs of senility.

These are among the findings reported to the National Academy of Sciences, on measurements of 150 of its own members made by Dr. Ales Hrdlicka, physical anthropologist of the U. S. National Museum. One hundred of these are men of "Old American" stock, the remaining fifty are European born or of more recent American derivation.

"The membership as a whole represents in every respect a normal group, above the average of the general population," commented Dr. Hrdlicka. "The total of the results indicate that, barring rare exceptions, the membership of the Academy represents not only mentally but also physically a select group." — *Science News Letter*

Propose an Institute of Industrial Medicine

A national institute of industrial medicine to protect the health of American workers was proposed to the American Public Health Association by Dr. Henry H. Kessler, medical director of the New Jersey Rehabilitation Commission. The working group must not be looked on as a special class, Dr. Kessler said, for today it forms the larger part of our entire population, and since the mechanization of agriculture includes the farmers of the country. The average worker lives six or eight years less than the average member of the population, Dr. Kessler pointed out in calling attention to the need for special means of protecting this important class.

The institute, as Dr. Kessler outlined it, would have a four-fold function. It would promote research in industrial diseases. It would sponsor a campaign to teach the worker how to protect his own health. It would sponsor legislation for the protection of the worker and develop standards of industrial health.

An important function of such an institute would be the creation of a panel of qualified medical and non-medical experts who could be called on in litigation over industrial diseases, compensation cases, and the like, thus correcting the present abuses in law cases involving occupational disease.

The proposed national institute of industrial medicine is in line with the present trend of governments assuming more and more responsibility for the protection of life and health of individual citizens, Dr. Kessler pointed out.

The two chief occupational diseases, he said, are silicosis in the dusty trades, and skin diseases from exposure to irritating chemicals in various industries. — *Science News Letter.*

Physical Therapy Fellowship at Mayo Clinic

It is gratifying to publish the following important announcement received from Dr. Frank H. Krusen of the Mayo Clinic:

"With the cooperation of the Graduate Committee of the University of Minnesota School of Medicine I have been able to arrange for a three-year fellowship to prepare qualified physicians to specialize in physical therapy. This new fellowship is, I feel, a distinct advancement in the field of graduate education in physical therapy and I should like it to be known that such a fellowship is available to qualified physicians. The first two fellowships have been awarded and two men have now started training here.

"The course offered includes:

"1. Training in certain fundamental subjects: (a) physics, (b) anatomy, (c) physical chemistry, (d) physiology.

"2. Training in research: (a) one or more assigned or selected problems in laboratory research related to physical therapy, (b) one or more assigned or selected problems in clinical research or some phase of the clinical application of physical agents.

"3. Clinical and hospital training in the study and treatment of patients by various physical agents.

"4. Elective studies in various branches of medicine related to physical therapy.

"The course is flexible and the fellow may select, with the advice of his instructors, those phases of the fellowship which best fit his particular needs."

Radium Given to Bohr to Honor His 50th Birthday

As a gift upon his fiftieth birthday, Prof. Niels Bohr, leading Danish scientist, one of the creators of the new physics and Nobelist, was presented one hundred thousand kroner ($22,500) for the purchase of half a gram of radium. The precious element will be used by Prof. Bohr in his private scientific research upon the constitution of matter.

Eight industrial firms and ten scientific foundations of Denmark joined in making the gift to Prof. Bohr.

Radium constantly disintegrates and shoots off powerful atomic projectiles and rays. Prof. Bohr will use these in bombarding the atoms of various elements to discover how they are put together.

Colleagues in science from all over the world sent messages of congratulation to Prof. Bohr.

"Original researches like those of Bohr are a bulwark against the destruction of our culture by fanaticism," Prof. Albert Einstein wrote from America.

"Bohr's achievements are epochmaking and have had an outstanding effect on the advance of physics," Lord Rutherford of Cambridge University, England, said.

Prof. Werner Heisenberg, German physicist, said: "The Bohr Institute is the world center of modern atom research."

Prof. Max Planck of Germany wrote: "Bohr's research has given a new turn to scientific evolution."

Prof. Georg von Hevesy, German discoverer of the chemical element hafnium, commended Bohr's warm personality and declared him to be a "historical phenomenon" as a thinker.

The co-discoverer of artificial radioactivity, Mme. Irene Curie-Joliot, also daughter of the isolators of radium, wrote from Paris: "Bohr is one of the great masters of theoretical physics." — *Science News Letter.*

Tungsten Alloy Aids Cancer Treatment by Radium Rays

A new tungsten alloy which effectivtly takes the place of more bulky lead as a "screen" when massive doses of radium rays are being administered has been developed for use at the Westminster Hospital, London.

The bomb-shaped containers in which large packs of radium are shielded in hospitals can be made much smaller with the new alloy and yet have the same screening effect. A volume reduction to nearly half the former size is attained.

More compactness means that the patient can be placed closer to the source of the radium rays, if need be, and receive more intense radiation.

The new tungsten alloy resulted from the researches of Sir John McLennan while he was scientific advisor of the Radium Beam Therapy Research Company and of Dr. C. J. Smithells of the (British) General Electric Company. Sir John recently died while on a vacation on the continent.

When massive doses of gamma rays from radium are administered to cancer patients, a large amount of radium is necessary. Many authorities believe not less than four grams of radium, valued at close to $200,000 is the minimum. This potent radium pack is shielded so that its piercing gamma rays do not strike doctors and nurses or any parts of the patient's body except the afflicted area.

The complete equipment, radium and its shield, is known as a radium bomb.

Although lead is easily shaped and machined, and is relatively cheap, it takes a somewhat unwieldly size of lead bomb to provide adequate screening for four or more grams of radium.

The screening effect of lead is due to its high density (11.35), the degree of absorption of gamma rays by metals being nearly proportional to the density of the metal.

Plainly, a smaller quantity of a denser metal than lead would have an equivalent screening effect, but the only suitable metals in this category are gold, platinum and tungsten. Of these the first two are prohibitively expensive.

There remained tungsten, best known in the form of electric lamp filaments.

Tungsten's high theoretical density (19.3) is only found when the metal has been treated by expensive metallurgical processes.

The difficulty of cost was overcome by the tungsten alloy. By adding from 5 to 10 per cent of either copper or nickel, an alloy of a density in the neighborhood of 17 could be successfully evolved on the desired scale, and for about $5.00 per pound.

The tungsten alloy radium bomb is only 64 per cent as large as the lead bombs previously used. The size is in the ratio of the densities of the two materials, 11 to 17.

The new tungsten alloy has been adopted for use by the Westminster Hospital for its 4-gram radium bomb now being constructed under the direction of Dr. H. T. Flint and C. W. Wilson. It is also to be used for the radium bomb at Birmingham, England.

Cosmic Rays Charged Equally Positive-Negative

Cosmic rays which continually bombard the earth from outer space must be electrically-charged equally positive and negative — not predominantly positive as believed by Dr. A. H. Compton and other leading authorities on the rays.

This opinion is expressed by Dr. W. J. Walke, British physicist working at the Radiation Laboratory of the University of California.

Dr. Walke's argument is that if the earth had been bombarded, throughout its existence, by a cosmic radiation whose electrical charge is predominantly positive, it would gradually have acquired a high positive potential. It should, therefore, by now have reached a point where its high positive charge would repel the positive components even of the powerful cosmic radiation; at the same time it would strongly attract the negative components, so that the net result would be an eventual decrease of the earth's potential until the reaching of a point of equilibrium — with equal numbers of positively and negatively charged rays coming to the earth. — *Science News Letter.*

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DIE KURZWELLENBEHANDLUNG IN DER CHIRURGIE (Short Wave Treatment in Surgery). By *Dr. Alfons Lob*, Roentgen Department of the Surgical University Clinic in Munich. Paper. Pp. 68. Price Rm. 3. 60. Stuttgart: Ferdinand Enke Verlag, 1936.

At first blush the title conveys the impression that the author has presented a study of short waves for surgical purposes, but on perusal one realizes that the small monograph does not materially differ from the books dealing with the medical application of short wave diathermy in affections characterized by inflammation or pyogenic infections. Nevertheless this addition to the literature is interesting, because Lob has taken virtually a negative stand regarding the value of the short waves, so much so that though he apparently has prepared the book for surgeons and has given as its *raison d'être* the circumstance that the surgeons will not take up this type of diathermy unless they become convinced of its value, few surgeons will care to become equipped for such therapy if they accept him as an authority. Although not so grouped, the book may be divided into two parts. In the first one finds terse and lucid discussions of the physics, physiologic and biologic effects and technics of short waves as compared with conventional diathermy. The latter part is devoted to a clinical study of regional pyogenic infections, subacute and chronic surgical infections, specific inflammatory processes (tuberculosis, gonorrhea, actinomycosis), injuries of bones and joints, affections of the muscles and peripheral nerves, and postoperative conditions of joints, fistulae and adhesions. Tumors are mentioned both from experimental and clinical standpoints, and, as can be imagined, as a hopeless field for the therapy under consideration. One page (!) is devoted to borderland, gynecic, otologic and dental conditions in which the short waves have been tried. Lob reaches the conclusion that the great expectations aroused by the literature have not been realized. It is only in the subacute and chronic affections that short wave diathermy has proved useful. Lob admits its superiority over conventional diathermy because of the greater depth of the heat and its resultant hyperemia, but in spite of this even in subacute and chronic conditions, x-ray therapy has often proved more effective. With such an attitude, the question suggests itself how one can compromise the statement that short wave therapy has a good effect in some inflammations and not in all affections in which the artificial production of hyperemia has proved curative in the hands of many observers. Lob has rejected a number of claims made by Schliephake and other pioneers on the ground that he has been unable to verify them on a large clinical material. While he makes the general statement that he has tried out every type of wavelength, he presents no concrete evidence that he has carefully followed the technics employed by other writers. There is no question that the last word on the value of short wave diathermy has not yet been spoken. There are still a number of biologic and therapeutic problems awaiting solution, but in the main no doubt is left that even surgeons will find this agency a decided, nay indispensable help in the management of many surgical conditions, irrespective whether surgical intervention is indicated or not. Accordingly Lob's exposition has much that is interesting and even instructive, but his clinical arguments are far from convincing and should be considered with an open mind.

ARTHRITIS AND RHEUMATOID CONDITIONS. Their Nature and Treatment. By *Ralph Pemberton*, M.S., M.D., Professor of Medicine in the Graduate School of Medicine, University of Pennsylvania, etc. Second Edition. Cloth. Pp. 455 with 69 engravings and color plates. Price, $5.50. Philadelphia: Lea & Febiger, 1935.

The increasing interest in the problem of arthritis has been due as much to the cumulative demands of industrial and actuary sources for a more intensive program of its control, as to the clinical and laboratory knowledge on the subject. No doubt both factors have been a means to an end — the relief of an ever widening group of patients who have become invalided and crippled to the detriment of our modern social-economic structure. The second edition of this book recognizes the protean nature of arthritis and discusses at interesting length the control and amelioration of this disease. Pemberton "is of the firm opinion that no single or fixed viewpoint can encompass the rheumatoid problem which, despite the fine achievements of the doctrine of focal infection, is not a disease of the specialist in any branch of surgery." Accordingly the author points out that the objective of his thesis has been to avoid undue emphasis upon any single phase of treatment but rather to present only that "wide-angled vision" which makes for a more critical and intelligent evaluation of the problem. The present work therefore not only carries out the original program of reviving interest in this age-old problem, but also includes much of new material. It contains over a hundred pages of new text, in which is incorporated the author's most recent clinical and laboratory investigations of the underlying physiopathological disturbances, the provocative etiologic factors, the symptomatology and successful treatment. The entire exposition is both rational and conservative, pointing out that no specific or *sterilizans magna* has as yet been found and perhaps never will, because of the diversified nature of the causative factors. The role of physical therapy is conservatively but intelligently expatiated, and emphasizes the fact of its conspicuous role in the relief of pain and the restoration of function.

While one may often find in any text inadvertent minor typographical errors to which this work is not an exception, it is startling to note that two complete chapters although listed in the table of contents are missing. We refer to chapters 7 and 8 — "The Coordination of Treatment in Arthritis and Rheumatoid Conditions," and "Arthritis in Childhood: Gonorrheal Arthritis: Acute Rheumatic Fever and Other Conditions," a printing error of no small importance. Here and there one also encounters a looseness in terminology not in keeping with the well knit rhetoric of the author. The author often uses the interchangeable terms of physiotherapy for physical therapy and on occasion, gonorrheal for gonococcal arthritis. It is believed that "physical therapy" is the preferred term of the Council on Physical Therapy of the American Medical Association, and "gonococcal" the more precise description related to specific arthritis. With the exception of the major omission, the above criticisms, however, are but minor considerations as compared to the informative and critical exposition of one of the most important problems now engaging the attention of the medical profession.

TUMORS OF BONE (Including the Jaws and Joints). By *Charles F. Geschickter*, M.D., and *Murray M. Copeland*, M.D. Surgical Pathological Laboratory, Department of Surgery, Johns Hopkins Hospital and University, Baltimore. With forewords by *Dean Lewis*, M.D., and the late *Joseph Colt Bloodgood*, M.D. Revised Edition. Cloth. Pp. 832 with 525 illustrations. Price $6.00. New York: The American Journal of Cancer, 1936.

When the first edition of this book appeared in 1931, it was generally recognized to be of value not only to pathologists, surgeons and radiologists but to general practitioners as well. This rightly so, because the subject of bone tumors, benign and malignant, was an obscure one in some phases, especially those pertaining to etiology and pathogenesis. Then the question of the therapeutic value of radium was still *sub judice*. In the first edition the authors shed much light and brought about a satisfactory grouping of the diverse neoplasms. In the five years that have elapsed they have accumulated much material especially with reference to osteogenesis, while check-ups brought valuable information about the percentages of cures obtained by diverse methods of management, including that of metastases, osteogenic sarcoma, and the like. The authors have not only revised the text, but have added quite a number of new chapters dealing with Ewing's sarcoma, tumors of the cranial bones, jaws, tendon sheaths, joints and bursae. A new chapter on the differential diagnosis of bone diseases rounds out the study. While one cannot adequately praise the authors for the enormous amount of work they have accomplished, one must not overlook the fact that the more than five hundred photographic, histopathologic and roentgenologic illustrations are of such excellent quality that they constitute a veritable atlas of invaluable aid in overcoming the common difficulties still encountered in the establishment of diagnoses. This monograph certainly adds lustre to American medicine. The American Journal of Cancer has earned the appreciation of the medical profession of the entire civilized world for having spared no expense in the mechanical production of this splendid volume and for offering it at a price within the reach of all.

INJURY AND INCAPACITY: With Special Reference to Industrial Insurance. By *H. Ernest Griffiths*, M.D. (Lond.), F.R.C.S., Surgeon, Albert Dock Hospital; Surgeon, Hertford County Hospital., etc. Cloth. Pp. 270. Price, $5.00. Baltimore: William Wood & Company, 1935.

The present age has often been referred to as the mechanization period of civilization, because the trend of progress has been on the emphasis of the machine, rather than the hand. It is also referred to as the industrial age because the tempo of all industries has been intensified. Hence the contemporary period is greatly influenced by forces typical of our times, and the individual is subjected to the hazards of greater injury and incapacity. The work under consideration is therefore a timely contribution because it conveys an important message to the medical profession, to the industrial world and to the social organism whose unceasing toil has largely been responsible for the comforts of our communal life. Since the largest percentage of injuries results from accidents caused during or on account of employment, those individuals are entitled to an equitable compensation, to proper care and to an intelligent prognostication satisfactory to all interested parties. The major fault in this situation is not the lack of cooperation of patient and employer, but the disjointed system of medical treatment due to the complexity of the problem. This work therefore attempts to "establish a basis for estimating the probable period of incapacity for any given injury, in any particular patient, having regard to his present employment and his ability to earn in any other employment." This is based on the author's wide experience and resort to the records of one of the leading insurance companies in Great Britain from which an exhaustive analysis of 50,000 consecutive cases of accidents was made. In the space of thirteen chapters listing the disabilities and the major injuries possible to various parts of the body, the author describes in detail and in concise fashion the tremendous number of accidents possible to sustain by those employed in modern industries, tabulating the average period of incapacity from work, and explaining the requirements of the men engaged in labor. For the latter purpose a series of 24 physical types is compiled and attempts have been made to describe a definite anatomic and sometimes physiologic standard essential to the laborer. The need for a work such as this is so obvious that it will undoubtedly not only be received with enthusiasm by the industrial surgeon but will be accepted as an authoritative reference by the general profession.

INTERNATIONAL ABSTRACTS

The Results of Craniocerebral Iontophoresis. H. Ehrenwald.

Wiener med. Wschr. **10**:11, 1936.

In his report on 250 cases, the writer maintains that the quick and often lasting effect is due to deep-reaching hyperaemia, possibly also to secondary reactions of the nerve centers. A sheet of white filter paper or a Katexon foil moistened with 1:5000 histamin or 1:150 dionin + 20 gm. sugar is placed either on the forehead or the back of the neck according to the region it is desired to affect, and connected with the positive pole of a galvanic current by means of a thin lead plate placed on top of it (as is done with diathermy). The negative electrode with a cloth moistened with water is placed on the opposite side, on the back of the neck or the forehead, respectively. Both electrodes should be kept in place by means of a bandage. If the object is to produce hyperaemia in both the anterior and posterior vascular domain of the head, both electrodes are moistened with histamin or dionin, which is equally effective, and the current passed first in one and then in the other direction. Strength of current: 4-5 milliamperes for 5-10 minutes. Injuries need not be feared, but patients with a definite congestive tendency, congestive headache, a severe degree of arteriosclerosis of the cerebral vessels and haemorrhagic diathesis should be excluded. Conditions which indicate the treatment are: Any angiospastic disturbances of the cerebral circulation, especially migraine (abortive effect on the attack in a few minutes but lasting, it is true, only 4-6 hours), neurasthenic headache (the same effect but followed by permanent results after 12 to 20 sittings, at first twice daily, later every one to two days. Increase of the mental capacity); essential hypertonia (lowering of the blood pressure, improvement of headache, vertigo, tinnitus aurium, sleeplessness; only with severe cerebral sclerosis, »pale high tensions«, is there a paradoxical increase of the blood pressure!). In cases of high tension, the active electrode should be on the back of the neck. If there is doubt as to how the treatment will agree with the patient, a beginning should be made with 2-3 mA. for 2-3 minutes or with dionin 1:1500. The treatment should be discontinued if the blood pressure rises. — Other indications are given by vasomotor neurotic disturbances following concussion of the brain or injuries to the skull (headache, conditions of vertigo, tinnitus aurium, etc.). Even with pressure on the brain due to tumor, hydrocephalus, etc., symptomatic results may be achieved. The troubles due to serous meningitis after insolation are permanently cured after 4 sittings. A number of the patients with troubles following lumbar puncture responded very well to iontophoresis whereas others remained quite unaffected.

Much may be expected from a combination of iontophoresis producing hyperaemia with specific chemotherapeutic measures, e. g., in tabetic atrophy of the optic nerve and in cases of tabes dorsalis combined with dementia paralytica. — (Ars. Medici, No. 8, 1936.)

The Treatment of Paralyzed Persons With Under-Water Exercises. H. G. Scholtz.

Deutsche med. Wschr. **11**, 1936.

In a paper read before the Berlin Medical Association, the speaker maintained that active movements are always the strongest stimulant for the restoration and preservation of an injured nerve cell. Remedial exercises have therefore played an important part in the treatment of paralytic disease from time immemorial, but their use is strictly limited in cases of serious spasms or of highly flaccid paralysis. In such cases, treatment by exercises under water has proved eminently helpful. This method was advocated long ago, by Leyden, Goldscheider and Senator, but only in recent times has it been used on a large scale, especially in America, at the model institutions at Warm Springs.

Under-water exercises have various advantages. The dead weight of the body is almost neutralized by the buoyancy of the water so that even the slightest effort produces a perceptible movement. Both doctor and patient often discover in the bath that the paralysis is not as complete as had seemed. The patient is inspired with fresh hope and his volition tracts are reinvigorated; the results achieved spur him on to work indefatigably. In order to give fresh stimulus to his lost »feeling of innervation«, every movement in the water is helped at first by an assistant, a »gymnast«, and the patient is urged to concentrate his attention on the movement being made. Another advantage is that in the bathing pool the movements of the limb and trunk can be made in any direction and that with sideways movements especially there is no friction against an underlying surface. Finally, the warm bath produces general relaxation, reduces the excitability and moderates the spasms which are often extremely painful.

Exercises in an ordinary bath tub which were originally recommended are only a poor makeshift; far better results are achieved in a bathing pool which, of course, requires a somewhat complicated equipment and a devoted staff. The writer has treated his patients for over a year in a bathing pool more than 5 m. long, 4 m. broad and 2 m. deep in which there is a table for massage and another for resting. The »gymnast« must remain in the water during the whole

treatment. Seriously paralyzed patients are at first carried to the massage table on a stretcher and the treatment is begun with passive movements which the patient should abet as much as he can. In between, the limbs that are doing the exercise are massaged under water; massage with a jet of water at a temperature of 140 degrees and a pressure of 2½ atmospheres has proved most valuable. Over the pool there is a rail with a handle running on rollers on to which the patient can hold when he is doing walking exercises. It is also possible to attach a life belt to the rail. This appliance is especially valuable for exercises of the pelvic, dorsal and cervical muscles in cases of paralysis due to poliomyelitis. The gymnast should see that all the exercises are carried out calmly and to the purpose, the doctor should watch that all the paretic muscles are thoroughly exercised. In the course of time the patients themselves realize what is essential so that several patients can be in the bath together under the supervision of one gymnast. The patients generally stay in the water for half an hour to an hour and should then have a long rest.

The writer has treated 50 patients by this method with most striking results. They included cases of disseminated sclerosis, spastic paresis due to lesions of vertebrae and flaccid paralysis due to polyneuritis or poliomyelitis. For tabetics, however, the under-water treatment seems less suitable. — (Ars. Medici, No. 8, 1936.)

The Effect of Hyperepyrexia on the Human Blood Count, Blood Chemistry and Urine. J. F. Simon.

J. Lab. and Clin. Med. **21**:400, 1935.

Artificial fever was produced by a standard hyperpyrexator cabinet whereby hot air was applied to the surface of the body. Urine and blood were obtained immediately before entering the cabinet and after the temperature had returned to normal. Water was given freely, but nothing else allowed. At first the blood became diluted and later concentrated; the blood sugar rose, but there was no glycosuria even when the accepted renal threshold was passed; the blood chlorides decreased about 2 p. c. The white blood cell count rose, due at first to the granulocytes. The urine became increasingly alkaline, and creatinine and non-protein nitrogen rose. — [Abst. in Physiol. Abstracts **21**:125 (May) 1936.]

Treatment of Intestinal Tuberculosis. R. H. Walker.

West Virginia M. J. **32**:250 (June) 1936.

The medical profession has for many years marshailed all of its forces against tuberculosis in all of its forms. Intestinal tuberculosis is the most frequent and decisive complication of pulmonary tuberculosis. It occurs in from 50 to 80 per cent of all fatal cases. This complication is very frequently the deciding factor in the fight waged between the infecting organisms and the vital resistance of the individual. A patient afflicted with pulmonary tuberculosis, free from the intestinal complication, has an excellent opportunity for recovery. Treatment in all forms of tuberculosis should be directed toward the prevention of complications — in fact, the very essence of the treatment of this complication is prevention.

The management of intestinal tuberculosis is essentially medical and is based upon the long recognized principle of rest, diet, hygiene, and heliotherapy. The first three factors have been commonly employed, but heliotherapy or light rays, is the outstanding development of the last decade in the treatment of intestinal tuberculosis. The ancients recognized the curative and healing power of sunlight and patients were exposed to the rays of the sun as a part of the treatment since the first days of medical science. The new and improved appliances by which the light rays, direct and concentrated, may be administered in a scientific manner has effected the cure of many patients and has given relief from pain to many others.

The perfection of x-ray technic has made possible the early detection of the intestinal complication. Their science has also made possible the use of heliotherapy as one of the most important factors in the arrest and treatment of the disease. The development of the x-ray and the use of heliotherapy are the two real outstanding achievements in medical science in the war against tuberculosis.

Velocity of Blood Flow in Therapeutic Hyperpyrexia. I. Kopp.

Am. Heart J. **11**:475 (April) 1936.

Kopp induced therapeutic fever in two patients with dementia paralytica, one apparently free from heart disease, the second with syphilitic aortic regurgitation and cardiac hypertrophy; the arm-to-tongue velocity time was determined by the decholin method. During the second half of the fever treatments of the patient with an apparently normal heart an increase in the basal velocity of flow occurred and was accompanied by an increase in the pulse rate. The basal velocity of blood flow of the patient with syphilitic heart disease tended also to increase as fever therapy was continued but was accompanied by a slowing of the pulse rate. It is suggested that the changes in the basal velocity of blood flow and pulse rates of both patients are due to the beneficial effects of therapeutic fever on the myocardium, the changes in the patients with syphilitic heart disease resembling those characteristic of digitalis therapy. Therapeutic fever caused an increase in the velocity of the blood flow in both patients, but no absolute quantitative relationship was found between the percentage increases in the velocity of flow and the degree of temperature rise. The increases in the velocity of flow were least marked during typhoid vaccine fever. Based on average values for nearly similar rises in body temperature in diathermy fever, the increase in the velocity of the

blood flow in the patient with syphilitic heart disease was much greater than that of the patient with an apparently normal heart. The response of the cardiovascular system to induced fever is proposed as a new test of vardiac function and reserve. — [J. A. M. A. **107**:159 (July 11) 1936.]

Electrosurgical Appendectomy. Lester R. Whitaker.

New England J. M. **213**:856 (Oct. 31) 1935.

Among surgeons there is considerable difference of opinion with regard to inversion of the stump of an appendix. The opponents hold that when the stump is tied and inverted it is simply buried in the wall of the cecum; that this leads inevitably to inflammatory changes in the wall, and possibly to abscess. They maintain that perforation of the gut during the insertion of the purse-string suture may lead to infection; and finally that the whole process may result in extensive adhesions around the cecum.

Electrosurgical appendectomy avoids the danger of contamination and hemorrhage, and at the same time prevents formation of an abscess in the cecal wall about the inverted stump. After cutting away the mesentery, the base of the appendix is crushed over a distance of about a half-inch, down to, and perhaps including a small portion of the cecal wall. The pressure should not be vigorous enough to crack through and produce contamination. The crushed mucosa and fecal contents of the lumen are pushed out by squeezing with the clamp, which is discarded. A tie of coarse linen is placed around the base of the appendix in the crushed zone; that is, a small devitalized section is left below the linen tie. Then a clamp is applied about a half-inch distal to the tie. With the cutting current, heavy dehydration, low voltage, and using a needle electrode, the appendix is cut off. The cutting is done with the side of the needle, progressing slowly, perhaps moving the needle from side to side a short distance to make it act more as an ordinary cautery, to seal off the lumen as it is cut across, and to sterilize the fecal contents. Then with the "coagulating current," using biterminal fulguration (sparking), the whole stump is thoroughly treated, including the small crushed portion of the cecum below the linen tie. The devitalized stump is then inverted with a double row of Lembert sutures. A closure as secure as would be required with a hole in the bowel is necessary.

Experimentation upon dogs has shown that the stump sloughs off into the cecum within twenty-four hours, leaving the walls nicely inverted and approximated at this point.

In three patients who died after major abdominal operations where incidental appendectomy was performed by this method, the cecum was examined postmortem. In one, after forty-eight hours, the stump had sloughed into the lumen of the bowel leaving the inverted edges closely approximated. In the second, also after forty-eight hours, the stump was hanging by a few small threads of necrotic tissue, and the closure of the cecum underneath it was firm. In the third, after four days, the edges of the infolded gut were clean.

Examination of the records of fifty personal cases of electrosurgical appendectomy reveals good results. The method was used only in those cases in which there was no induration of the cecum itself. The average stay in bed was eight and one-half days. There were no untoward symptoms, nor any complications referable to the abdomen.

The advantages of electrosurgical appendectomy as described are as follows: It is simple and aseptic; it promotes rapid sloughing of the stump into the lumen of the colon, without danger of hemorrhage or abscess of the cecal wall; and it leaves a firm closure of undamaged tissues.

Diathermic Tonsillectomy by Electrocoagulation. R. C. McLaughlin.

California and West. Med. **43**:39 (July) 1935.

Tonsillar remnants may be removed with as little trauma or inconvenience as possible. Patients who require tonsillectomy, and who are partially or wholly disabled with such diseases as tuberculosis of the lungs or glands (scrofula), cardiac lesions, hemophilia, make suitable subjects. In certain individual cases where the tonsils, acting as foci of infection producing pathologic changes in other parts of the body, may be treated and sterilized effectively by electrocoagulation without their complete removal. Hemorrhage is less frequent by this method, and carries perhaps some economic advantages.

There are also certain disadvantages in the method.

For their complete removal tonsils require frequent treatments at intervals of seven to ten days and lasting over a period of six to eight weeks. Some patients become impatient of this lengthy treatment, despite their initial enthusiasm, and require considerable persuasion to complete their treatments. Sore throat follows each diathermic application in varying degrees, as well as some toxic absorption. This produces more or less fatigue. In a few cases the soft palate and uvula become quite swollen, but is usually shorter than that following surgical tonsillectomy. Complete removal of the tonsils is not always accomplished because definite knowledge of removal of the capsule cannot be certain, as in the surgical tonsillectomy. Portions of tonsillar tissue may remain, and may become embedded and concealed by scar tissue. In the author's experience scar tissue formation is much more common following the diathermic method than the surgical method. It is difficult to determine, at or near the final treatment, whether one is coagulating lymphoid or muscular tissue.

Calcium Metabolism and Therapy in Dermatology. Everett S. Lain.

Southern M. J. **29**:626 (June) 1936.

The symptoms of calcium deficiency even to the degree of starvation are elusive and give no

early warning, perhaps not until after disabling diseases such as rickets and osteoporesis have developed. Many dermatologists have been favorably impressed with results from the administration of calcium in certain types of eruptions, particularly the allergic and toxic groups of dermatoses. Equally good results may also be obtained by the giving of calcium in the acute processes of dermatitis venenata. The author found that many of the so-called industrial dermatoses will respond with equal rapidity and satisfaction. The dosage and technic of the administration of calcium usually consists of the giving of calcium thiosulphate or calcium gluconate, 5 to 7 cc. of a 10 per cent solution, intravenously, daily at one or two-day intervals until three or four doses have been given. This is followed by powdered calcium gluconate or calcium lactate, 1 or 2 grams, dissolved in a glass of warm water taken between meals and continued as indicated. Calcium administered intravenously is not without danger, unless it is injected slowly and is not completed within a shorter period than three to five minutes.

Lain has found calcium of special value in all exudative dermatoses, whether arising from endogenous or exogenous irritating factors. It is of value for temporary relief in urticaria, lichen planus, erythema multiforme, dermatitis herpetiformis and senile pruritus. In two cases of acrodynia, calcium, with viosterol and quartz light, was used with excellent relief of excessive perspiration, acute sensitivity and rapid subsidence of the miliary erupation.

The author offers another treatment for seborrheic dermatitis. In addition to the local applications usually prescribed, the patient is given over a period of several months, foods high in vitamin D, ultraviolet light, either from the sun or quartz lamp, and calcium two or three times daily and watch his condition improve.

The Diagnosis and Treatment of Acute and Chronic Arthritis. Benjamin H. Archer.

Med. Rec. **143**:514 (June 7) 1936.

As a prophylactic measure, young adults subject to frequent attacks of tonsillitis or quinsy, who complain of twinges in the joints, should have their tonsils removed before the onset of joint changes. The treatment of all other infected foci should not be neglected, especially during the early stages of the disease. Once nonspecific arthritis is well established, the removal of local areas of diseased tissue is generally a futile procedure.

Physical therapy has a definite place in the treatment of nonspecific arthritis, but should be employed intelligently and conscientiously. The chief value of all the modalities of physical therapy is the vasodilatation which follows such treatment. This improves the circulation of the joints. It improves the tone of the muscles. Incidentally, it acts as an analgesic to the affected parts.

Vitamin D Milk: The Relative Value of Different Varieties of Vitamin D Milk for Infants. Philip C. Jeans.

J. A. M. A. **106**:2150 (June 20) 1936.

Exclusive of purely laboratory products there may be only two varieties of Vitamin D, one of animal origin and one of vegetable origin. All animal sources may have a vitamin D of the same value. The same is true for all vegetable sources. Vitamin D of the animal source appears to be more potent for the human being than the vitamin D of vegetable source. The degree of superiority is not entirely established, but on the basis of evidence available it may be in the ratio of 1.5:1 when vitamin D milks are compared. Animal source vitamin D milk with 135 rat units (U. S. P.) to the quart will prevent rickets, but this amount of vitamin D approaches closely the minimum effective level.

Prevention of rickets is not a criterion of adequacy of vitamin D intake. The amount of vitamin D that barely prevents rickets does not permit the best growth of infants, nor does it permit retentions of calcium and phosphorus as great as those considered desirable. Animal source vitamin D in the amount present in one standard teaspoonful of average high grade cod liver oil or in milk containing 400 units to the quart is adequate for the infant from the standpoint of calcium retentions and growth. The minimal amount that is adequate is not known. Vegetable source vitamin D has not been used in a manner which would determine directly the minimum rickets-preventive dose or the amount that permits good growth and retentions.

Ultraviolet Irradiation as Prophylactic for Cracked Nipples. E. K. MacLellan.

J. Obst. & Gynec. **43**:290 (April) 1936.

For two or three years MacLellan treated cracked and painful nipples that occur in the last month of pregnancy by exposure to air. A warm flannel cover for the breast with two small apertures to permit exposure was provided. There seemed to be a decided improvement. This suggested the use of the ultraviolet ray as a prophylactic agent. From six to eight treatments, depending on whether the patient is of the blond or brunette type, have been employed for the last two years. The treatment is started with one and a half minute's exposure at 40 inches and given three times a week, working up to ten minutes exposure per treatment. Only the nipple and areola are exposed. Since this treatment was started, in not one instance has there been even the slightest trouble, some fifty patients having been treated. — [J. A. M. A. **107**:82 (July 4) 1936.]

Infra-red Photographic Study of the Changing pattern of the Superficial Veins in a Case of Human Pregnancy. Leo C. Massopust.

Surg. Gynec. & Obst. **63**:86 (July) 1936.

Since the advent of infra-red photography, the superficial vascular system in the living is be-

coming an interesting field of study. The present report points to an infra-red photographic method for the visualization of the superficial blood vessels in the living. This method may be used in the study of the normal and abnormal superficial blood vessels by any clinician, who has available the ordinary photographic equipment. The only additions necessary are Eastman's infra-red plates type IR and the infra-red filter.

The method which the author has used since 1933, has proved useful in the study of the following clinical conditions: Varicose veins, superficial tumors, and thrombosis of superficial and deep vessels with subsequent changes in the superficial collateral circulation. In other words, it is of value in any condition that affects the superficial circulation in which heretofore the opacity of the skin prevented the making of clear photographic records. The method demonstrates the variable patterns in the superficial vascular system in the living and furnishes a permanent photographic record of any progressive or regressive change in these patterns.

Ultra-High Frequency. Phillippe Bauwens.

British M. J. **3945**:328 (Aug. 15) 1936.

Short wave therapy aims at making selected tissues of the body the seat of electrical oscillations of very high frequency. In order to attain this objective the tissues are included in an oscillating circuit in which, subsequently, conditions required to bring about resonance with a high frequency generator are satisfied. From a practical point of view the administration consists in adjusting the resonating circuit to the exigencies created by the complex load. As only the resonating circuit concerns the operator, mention is made of its function in relation to the treatment of the patient. Although on account of their high dielectric constant the tissues bestow an increased capacity on the field into which they are introduced, it must be remembered that they also act as conductors to the currents induced in them, and this phenomenon brings into existence two other effects. The most important is the alteration in the power factor. Briefly, when the load in an oscillating circuit is entirely capacitative the power factor is zero and no heat is produced, according to Joule's law, since in such a circuit the current is 90 degrees out of phase with the electromotive force. If, however, a resistive component is included, the power factor tends towards unity and becomes one when the load is solely resistive — that is, when the current and the electromotive force are in step. In a mixed load like animal tissue heat is produced, with a consequent rise in temperature. Some authorities reject the suggestion that ultra-high frequency fields have any action other than the production of a rise of temperature in the tissues, but to this one may object that since tissues act as capacity — that is to say, since they possess the property of storing electrical energy as a charge — they must become stressed when submitted to electromotive forces in an alternating electric field. Furthermore actual strains must result from sheer irregularity in the stresses due to the lack of uniformity of field density. These uneven stresses, with consequent straining at high frequency should not be visualized as causing coarse cellular movement, but rather as producing fine vibrations of smaller particles in various histologic structures, calling forth a nonspecific defensive reaction.

Although this effect is probably the one which invests ultrashort wave therapy with its advantage over diathermy, the thermal component of the treatment should not be overlooked. Since a rise in temperature will cause an acceleration of pathological processes as well as of defensive processes, in a large number of conditions it will be found that better results are obtained in fields capable of producing but minimal rises or no rise at all in the temperature. In short wave therapy we have acquired a therapeutic agent capable primarily of making tissues react against antigens and secondarily of causing local pyrexia, thus accelerating biochemical activity.

Fluorescent Lamp for Cataract Surgery. H. Rommel Hildreth.

Am. J. Opthal. **19**:770 (Sept.) 1936.

Ultraviolet rays cause the crystalline lens to fluoresce. This phenomenon is helpful in cataract surgery because of the sharpness with which the lens surface and cortical particles may be seen. The far range of ultraviolet rays are absorbed by the cornea and cause a photochemical reaction. With a suitable filter the fluorescent lamp may be used for ultraviolet therapy. Other filters make the lamp useful in photography of the eye.

The fluorescent lamp has gained an increasing amount of interest. Its use in the treatment of dislocated lens is invaluable. The carbon arc is itself a very rich source of radiant energy in the solar spectrum. With filters one may select certain bands of the spectrum for specialized use, as in photography, red-free ophthalmoscopy, and fluorescence. More recently the lamp has been used for treatment with a condensing lens made of special glass, which permits biologically active ultraviolet rays to be transmitted.

The chief value of the lamp lies in its use in cataract surgery. Particles of cortex and lens capsular remnants stand out clearly in the anterior chamber, and may easily be removed. When one grasps the capsule during intracapsular extraction its surface is so clearly demarcated that it is possible to discern the extent of the bite in the capsule forceps. If the capsule ruptures, the difficulty is easily seen at once and shows that further attempts at intracapsular extraction are useless. When capsulotomy is purposefully performed, the outline and extent of the capsule tear are shown. During expression of the nucleus or lens in capsule, the glowing mass stands out in striking contrast to the other parts of the eye. The capsule itself does not fluoresce, but adhering to it is a layer of cortex which

makes the capsule easily visible under close observation. The author has been able to detect small particles of capsule in the wound by means of the fluorescent lamp, remnants invisible under ordinary white light.

Therapeutic Pyrexia by Short Radio Waves. F. J. Nattrass, and S. F. Evans.

Quarterly J. Med. 5:187 (April) 1936.

An account is given of the development of electrical methods for the production of therapeutic pyrexia. A description is given of the essential features of an apparatus for the production of general pyrexia by means of short radio waves, and the technique of this treatment is outlined. The results of the treatment are discussed in fifteen cases of dementia paralytica, three cases of tabes dorsalis, and two cases of subacute combined degeneration of the spinal cord. As regards dementia paralytica, the conclusion is reached that the results compare favorably with those of malarial therapy, and that the electrical method is the safer, and capable of more precise control.

Surgical Diathermy Extirpation of the Lacrimal Sac. H. Rommel Hildreth.

Am. J. Ophthal., Series 3, 19:699 (Aug.) 1936.

Surgical diathermy has become thoroughly established in the treatment of retinal detachment, but its effective use in other connection still remain unknown to many eye surgeons. The author was confronted with a problem the virulency of which required both immediate decision and action. The disease was not the usual acute abscess formation but an intense cellulitis, caused by a virulent organism. The region itself was doubly dangerous since it overlay the cavernous sinus. These facts made sharp dissection unsafe because of the possibility of spreading the infection. The actual cautery would have been the instrument of safety a few years ago but the resultant burning is unnecessary and considerable, and the scars unsightly. The cutting current of the heavy-duty diathermy apparatus seemed to fulfill ideally the requirements of safety and effectiveness in this case. The heat seared the wound edges as cutting took place and thus provided the safety of the actual cautery. The incision on the other hand was as clean cut as if made by a sharp scalpel. Furthermore, the diathermy knife cuts with no trauma, a consideration of great importance. The tissues divide actually ahead of the moving knife in a melting-like process which is effected by the heat of the electrical current. (The blade itself is blunt.) As a consequence, the entire operation was done without the use of forceps, the knife and wire loop being the sole instruments. Absence of trauma in such a case was vital. The opportunity to work in such a field without manipulation of the tissues could be provided only by surgical diathermy.

Treatment of Angina Pectoris. Basil Parsons-Smith.

Lancet 2:549 (Sept. 5) 1936.

For practical purposes angina pectoris may be regarded as a symptom-complex characterized by paroxysmal attacks of substernal pain, constrictive in type. It is more often than not induced by muscular effort, exposure to cold or mental excitement and, in its severer forms is associated with varying degrees of circulatory collapse. The treatment of angina pectoris in all its forms is primarily dependent upon accurate diagnosis and this must be prepared by consideration of the patient's subjective symptoms. No single or specific pathologic process is concerned in the condition, in a considerable number, probably 25 per cent, the cardiovascular examination proving negative. Prevention of attacks is an essential consideration in the routine program of all patients suffering from anginal symptoms. An average patient should avoid excessive physical strain, prolonged exertion, exposure to weather extremes and mental stress. Adequate relaxation should be procured by rest or travel.

Digestive errors frequently complicate the anginal syndrome and should be corrected.

Obesity is a serious complication in patients with cardiac affections and should be counteracted. In an average case the weight should be reduced by roughly a pound a week. This can usually be achieved by moderate restrictions in the fat and carbohydrate intake; by occasional fast days, say once weekly, on which the diet is limited to tea, milk, gravy and fruit juice; by suitable exercise and such schemes of physical therapy (massage, baths, colonic lavage, diathermy), as the various spas now provide; and lastly by the prescription of thyroid abstract, if the metabolic rate is found to be subnormal.

Mobilization of Rheumatic Joints. M. Ory.

Ann. de Med. Physique 29:73 (April) 1936.

The causes of decreased joint mobility are divided into the true osseous and fibrous ankyloses resulting from trauma, congenital malformations, infections and neurologic disturbances on one hand, and the rheumatoid and hypertrophic arthroses where the disability is due to muscle contractures or bony projections at the joint interfaces which become progressive with continued "microtraumatism." In rheumatic fever with arthritis, the injury is as much general as articular, and during the acute phase, rest and even the application of a moulded splint is advisable. When the joint becomes quiescent, physical therapy should progress gradually from light massage, through passive and active motion to exercise. Motion should be as slow and prolonged as possible, and above all, painless. If there is any evidence of local or general reactivation, the treatment should be interrupted. In the more severe cases where there is early ankylosis, the joint should be placed in the position of maximum usefulness, using force, and if necessary lo-

cal anesthesia, because a joint in good position is more desirable than a more mobile joint in poor position. In the chronic arthroses, there is always the possibility of traumatizing the osteophytes with consequent inflammatory reaction. The muscular atrophy should be corrected by motion against graded resistances up to the threshold of pain. Since many chronic arthritics are plethoric and have a low basal metabolic rate, the judicious use of athletic activity will have a very favorable effect on the general as well as the local condition. The rhythmic rather than brisk activities are advised, such as swimming, walking, and even cycling. An exacerbation of pain in these patients should be treated by rest in bed.

Chronic Prostatitis and Prostatic Calculus. Treatment by Incision with the Electrocautery. Gershom J. Thompson and Edward N. Cook.

J. A. M. A. **104**:805 (March 9) 1935.

In the past three years sixty-seven patients have been subjected to electrocautery operation. All of these patients had single or multiple chronic abscesses, and seven had prostatic calculi in association with the infected pockets. After describing the method and technic of the operation, the authors presented the following conclusions:

1. Chronic prostatitis often persists because of infected pockets or diverticula that drain only through a small prostatic duct.

2. Treatment by ordinary methods, such as massage, irrigation, injection of antiseptic substances, or diathermy, results only in temporary relief of symptoms.

3. Surgical treatment of these regions by the transurethral route will insure adequate drainage and subsequent improvement in a large percentage of cases.

4. The prostatic cavities must be widely excavated in the form of a saucer, and, if necessary, tissue must be excised to provide free flushing at the time of urination; otherwise infection will persist.

5. Calculi embedded in the prostatic tissue, which occur either primarily or secondarily to prostatic infection, can be removed by transurethral operation.

Electrosurgical Technic of Tonsillectomy Under Local Anesthesia. P. W. Malone.

Arch. Otolaryng. **21**:93 (Jan.) 1935.

By means of undamped high frequency electrosurgery, operative and postoperative bleeding rarely occurs. The author has seen only three patients who had postoperative hemorrhages. Dissection of the tonsil can be carried out under direct view with no blood to obscure the operative field. This eliminates the possibility of damage to the pillars and the tissues of the sinus tonsillaris. Although postoperative discomfort and time of healing are about the same as with other technics, there is less scar tissue, and certainly the throat looks smoother and cleaner than with any other method.

The Effect of Visible Radiation and Eosin on the Rachitic Rat. A. Szczygiel and J. H. Clark.

Am. J. Hygiene **21**:224 (Jan.) 1935.

The familiar physiological effects produced *in vitro* by ultraviolet radiation, such as the denaturation of proteins, the destruction of enzymes, the hemolysis of red cells and the lethal action on microorganisms, can also be brought about by visible light in the presence of certain specific sensitizers. It has therefore been assumed that the rôle of the sensitizer is to extend the range of action of short wavelengths into the visible region. Blum has, however, questioned the validity of this generalization and emphasized the fact that oxygen is necessary for the reactions produced by visible light and a sensitizer whereas certain changes produced by ultraviolet radiation take place in the absence of oxygen.

As sensitization occurs in the region of the absorption band of the sensitizer, chlorophyll sensitizes to red light, eosin to wavelengths shorter than 550 mu., and it has been suggested that since sensitizers absorb in the ultraviolet region they increase the sensitivity of biological systems to ultraviolet radiation. Although many substances are effective *in vitro* very few will sensitize animals and the most effective of these is hematoporphyrin, which is known to produce a condition of sensitization to visible light in mice, dogs and men. There are a number of reports indicating a slight degree of sensitization in animals and men as a result of the injection or ingestion of eosin. Raab and Hausmann both reported sensitization of white mice to visible light by means of eosin. Campbell and Hill produced stasis in the capillaries of the frog mesentery and Levy produced necrosis of the skin in the ear of a mouse with eosin and visible light. Eosin has been used to sensitize human beings but the degree of sensitization produced is not definitely indicated. Studies on animals show no evidence of prevention of rickets when rats on a rachitic diet were exposed to visible light after oral administration of eosin.

Some Observations on Ultraviolet Irradiated Amebas. W. A. Black.

Science **82**:495 (Nov.) 1935.

Preliminary to a study of the manner in which various solutions of sodium chloride modify the action of ultraviolet radiation on protoplasm, Black did a number of experiments on ameba proteus. His observations on irradiated amebas indicate that digestion of food is stopped by ultraviolet rays and that cessation occurs with the appearance of morphologic symptoms of impairment. Ameba proteus shows negative phototropism toward ultraviolet radiation. The cell membrane of irradiated amebas is relatively inextensible. — [Abst. J. A. M. A. **106**:254 (Jan.) 1936.]

Experiments With Galvanodiathermy. H. Bordier and T. Kofman.

Arch. D'Elect. Med. **44**:69 (Feb.) 1936.

When continuous and high frequency currents are applied simultaneously, each energy generator is made impervious to the other's current, by the interposition of a condenser at the diathermy end and two induction coils or chokes of such high resistance to the alternating current as to prevent its passing into the galvanic source. Previous workers in this field, claimed that the combination of these two currents produced an entirely new kind of electricity, and offered as proof, the increase in electrolytic activity. It was claimed that between three and five times more hydrogen and oxygen were liberated with the passage of combined current through water than with the use of the same intensity of direct current.

Bordier and Kofman believed that the heat generated by the diathermy current expanded the liberated gases and thus gave rise to false interpretations. Accordingly, they used the combined current of 95 ma. direct and 500 ma. high frequency to precipitate copper from a *2* per cent solution of copper sulphate for from one to thirty minutes and compared the weights of electrolytic copper obtained in this fashion with that obtained from the use of direct current alone, and found that there was no difference between the electrolytic effects of each.

Thermometallic Ionization in Old Otorrheas and Some Other Otolaryngologic Cases. Y. de Kerangal.

J. de Med. de Paris **56**:79 (Jan. 30) 1936.

When metals are heated their surfaces emit particles which the author calls ions and insists they are identical physically with the ions developed by the passage of a direct current through a solution of an electrolyte. With this hypothesis, the metal is heated electrically or in an alcohol flame, and a current of air is passed over it onto the diseased tissue surface. Such an air current is purported to result in a leukocytic response, a specific metallic bactericidal effect and a drying of exudates. Fourteen cases of intractable chronic mucosal disease in the upper respiratory tract are reported as cured after two to five "ionic insufflations." For nasopharyngitis silver is advised, for ear conditions copper, and in tuberculous otitis gold effected a rapid cure. The passage of the metal bearing air takes but two minutes and is at a temperature comfortable to the patient. The author feels that this method is particularly valuable in gold therapy where other methods of administration are contraindicated.

The Thermogenic Action of Sun Rays. J. Saidman.

Ann. de L'Inst. D'Actinol. **10**:174 (Aug.) 1936.

A large group of patients, including many tuberculous individuals, were exposed to the direct rays of the sun for a total of almost 15,000 treatments. In order to standardize dosage, the patients were placed perpendicular to the sun's rays and the amount of energy absorbed was recorded by an automatic thermoelectric mechanism. Treatment was given in energy units instead of minutes; each unit is equal to five calories per square centimeter of skin surface. If ideal energy conversion were possible, the body temperature would rise .2 degree C. for each unit. The rectal temperature was observed before and after each treatment. In only .2 per cent of all cases was such a rise seen. Saidman considers such a reaction a manifestation of thermic instability, and discounts the previous opinion that it is a common characteristic of tuberculous patients, by noting a similar frequency in other groups. These thermal responses, diminish under continued treatment, and seem to vary in tuberculosis, with the localization of the bacilli. Thermal instability seems to be most frequent in lupus, Pott's and pulmonary diseases, and infrequent in adenitis, epididymitis and peritoneal infections. Pulmonary lesions in themselves do not contraindicate heliotherapy. Inasmuch as febrile reactions are greatest at the beginning of a course, dosage should be increased very carefully at such time.

SHORT WAVE DIATHERMY IN HEATING OF HUMAN TISSUES *

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A review of recent literature shows that there still exists a difference of opinion on the problems of heating human tissues by short wave diathermy as was already pointed out in a previous study.[1] Schliephake[2] in a recent article asserts that he has experimental proof that ultrashort waves may produce effects which are not to be regarded as due to heat in the common sense of the word. Heat, he claims, is irregular motion of all molecules in a warmed area, but in the short wave field it is a regulated motion of definite particles and groups, and these are dependent on wavelength. He further maintains that clinical observations support this concept, and that there are effects which cannot be explained on the basis of general heat. He points out, however, (and the authors agree with him) that "we (Schliephake) have not yet the possibility to span bridges everywhere between the experimental findings and clinical results." The implication given is that regulated motion of molecules generates heat and some other potent force.

Whether the molecules have "irregular" or "regulated" motion, few will doubt that the end result of this effect therapeutically is heat. Unquestionably the medical profession would welcome proof of the hypothesis that there are brought about additional therapeutic effects apart from the heat produced. Until demonstrable facts supporting this contention are made available, the profession might well accept the explanation for the therapeutic action obtained on the basis of the heat generated.

It is again emphasized that experiments on phantom model and on dead animal tissues cannot be used to prove the effects of short wave diathermy on living human tissues. In a recent article Schliephake[3] seems to recognize this fact when he states: "one may offer the objection that we are dealing with experiments on dead material which have no application to living tissues. For this reason the selective effects have been demonstrated in human and animal components of tissues." These components of tissues were not living tissue. In his article he disregards entirely the literature that has appeared disproving selective heating of short wave diathermy. In attempting to prove selective heating he cited no experiments on living tissues that fulfill the requirements suggested by Karsner and Goldblatt[4] in their article on the evaluation of methods used in physical therapy.

Holzer[5] in considering specific action maintains that it is quite clear we are still in the realm of hypothesis, and that much experimental work must be done before these questions can be answered.

Eidinow[6] states that in his experiments he failed to demonstrate any direct bactericidal action or any biologic effect apart from that due to heat.

It is believed that certain previous experiments[1, 11, 12] showed that the therapeutic effects of short wave currents are limited to the effects of heat produced. This view is supported by the experimental work of Maloy,[7] who investigated the death of the Drosophila in the electric field of short and ultrashort waves (from 4.3 to 107.5 meters). Maloy shows that the death of

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 10, 1936.

the fruit flies was due to ordinary heating effects and that there were no noticeable differences in effect between short and ultrashort waves.

Hill and Taylor[8] experimenting with high frequency currents on an excised heart immersed in a small quartz vessel containing Ringer's solution, showed that the behavior of a frog heart, cilia and nerve muscle preparation exposed to the 3.4 meter wavelength is exactly the same as when merely heated in Ringer's solution. These authors conclude that the biologic effect is due to heat.

Wetzel and Kiesselbach,[9] in their work with wavelengths of 12 and 8 meters observed the effect of heat on tadpoles. These were placed in glass containers directly between two electrodes of a high frequency electric field. The water temperature rose very quickly in 15 minutes from 15 to 28 degrees C. and 5 minutes later to 36 degrees C. Those exposed to temperatures of 28 degrees C. showed no defect or change on the days following, whereas those in the temperature of 36 degrees C. died either immediately or soon after. Wetzel and Kiesselbach point out that the damage done to the tadpoles was due to heat, and explained it by the following treatments. The tremendous development of heat was partly reduced by placing 5 mm. of felt between the glass jar and the electrode. With this arrangement radiation during 15 or 20 minutes showed a temperature rise of from 9 to 12 degrees C. These radiations had no particular effects on the tadpoles. Wetzel and Kiesselbach then completely excluded the heat effect of the water. This was accomplished by running circulating water through the glass containers. The tadpoles were now radiated twice daily, half hour each session. No differences were noted as against control tadpoles which were not in the field. The test groups that had been radiated for 14 days were subsequently treated for another 2½ weeks daily, about 4 to 7 hours. At the end of these experiments no differences were noted between the treated and the untreated groups. This showed that when the heat is considerably reduced or excluded there is not noted any damaging nor any improving factor on the experimental tadpoles. These tests according to Wetzel and Kiesselbach support the assumption that the chief cause of the biologic action of the short waves is the heat that is produced by the energy exchange.

Curtis, Dickens and Evans,[10] in a recent article summarizing their investigations on specificity state:

> If such an effect exists, it should be possible for the discoverers to describe at least one clear-cut experiment which could be repeated by other workers. In the absence of such evidence we consider that the great mass of inconclusive observations which has been presented is a very insecure foundation for the rapidly growing belief in specific short wave therapy. Whilst the possible existence of specific actions of ultrashort waves cannot be denied, in our opinion such effects have not as yet been adequately demonstrated. We therefore find ourselves in agreement with the conclusions of a recent report to the Council on Physical Therapy of the American Medical Association, by Mortimer and Osborne: "There is no conclusive evidence from the literature; nor were we able to substantiate the claim of specific biologic action of high frequency currents (short wave diathermy). In our opinion the burden of proof still lies on those who claim any biologic action of these currents other than heat."[11]

Kovács[13] states that claims for selective heating by short wave diathermy in laboratory experiments have not been corroborated in the living human organism and do not hold out hope for any practical therapeutic value.

A previous study indicated that there are no significant differences of one wavelength over another within the range of 6 to 25 meters in the heating of live human muscle and fat tissues. Twelve additional experiments were performed which confirmed these former findings. The subjects were medical students who volunteered for these tests. Under aseptic precautions a nonmagnetic non-conducting sheath (through which the thermocouple needle

could be guided for temperature readings) was inserted subcutaneously and into the quadriceps extensor muscle. Temperatures of the skin, of the subcutaneous tissue, of the muscle and of the mouth were taken before and after a twenty-minute clinical application. All temperatures were permitted to return to the initial reading after each test.

Temperatures were taken by three thermocouples made of copper and constantan wires (28 gauge Leeds-Northrup double cotton covered), soldered into the tip of a 16 gauge lumbar puncture needle. The thermocouples were connected to the potentiometer (Leeds-Northrup portable precision type) through parallel double pole switches, a method that facilitated rapid reading of the individual couple.

The thermocouples were calibrated against a Bureau of Standards calibrated thermometer with scale division in one-tenth degree Fahrenheit. Since the thermocouple itself was affected by the high frequency currents, there were no thermocouples in place in the field during the passage of the current.

The intensity of the current was governed by the patient's tolerance; that is to say, the subject agreed to stand as much of the current as was possible without suffering discomfort.

Charts 1 and 2 provide additional information to confirm our previous studies on the effects of different wavelengths in the heating of human tissues. The additional information contained in these charts was obtained when using the electric field of a wavelength of 15 meters and the electromagnetic field of 25 meters. In the opinion of the authors the data confirm the previous findings that there are no significant differences in the heating of live human muscle or fat with different wavelengths of short wave diathermy current.

The lack of specific action of different wavelengths of high frequency energy in heating human tissues has not only been substantiated in our studies on the human thigh, but also in pelvic heating experiments. In a recent study of vaginal and rectal temperatures attained by utilizing 9, 15, 16.4, and 24 meter short wave medical diathermy, no significant differences in heating effects were found. When using electromagnetic induction with a 24 meter wavelength, a temperature rise of approximately 1½ to 2 degrees was found above that as when using the electric field. A study of these data indicates that the rise was not due to the difference in wavelength but to the method and technic of application.[14]

Schultze-Rhonhof and Rech[15] using 6 and 30 meter wavelengths found no depth heating of abdominal and pelvic organs. Horowitz et al[16] using nine different apparatus with wavelengths varying from 6 to 18 meters agreed with the above findings. With a 6 meter field short wave medical diathermy using metal vaginal electrodes, they obtained a rectal, bladder, and vaginal temperature of approximately 106 degrees F. Apparently this was not due to the difference in wavelength but to the technic employed.

In previous experiments performed with air-spaced electrodes using short wave diathermy the data obtained did not substantiate their advertised efficacy in heating living human tissues. In these experiments the electrodes were applied by representatives of the manufacturers according to their published technic. Recently a manufacturer suggested a technic which was different from the previously used method. With the air-spaced electrodes of a short wave diathermy machine placed on the anterior surface of the subject's thigh one proximally and the other distally to the thermocouple inserted as therein described, the muscle temperature after twenty-minute treatments equalled or exceeded that of conventional diathermy.

In applying these air-spaced electrodes the dosage was regulated by the

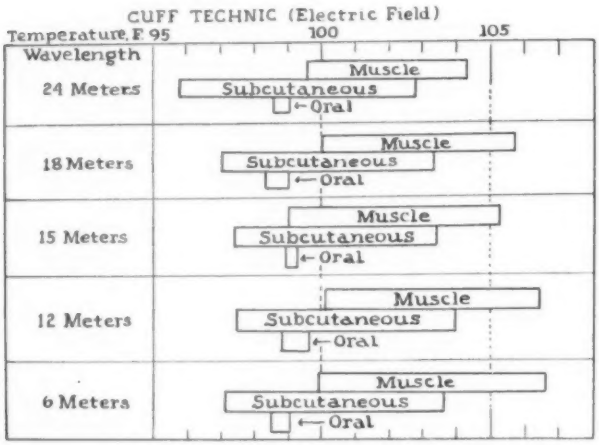


Chart 1. — Relationship of wavelengths to heating, illustrating tendency of greater heating in the muscular strata than in the subcutaneous.

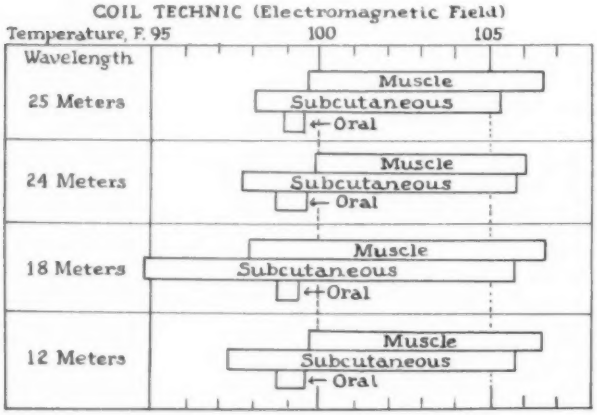


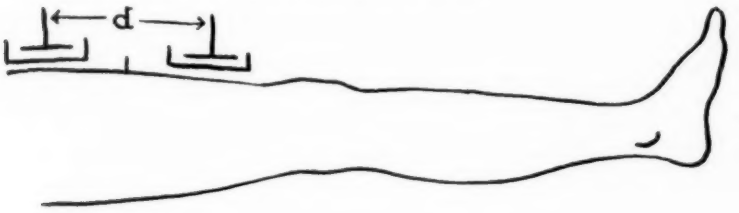
Chart 2. — Relationship between wavelength and temperature, illustrating the closer gradient of heating between muscular and subcutaneous layers.

patient's tolerance. The ability to heat the deep tissues of the human thigh with air-spaced electrodes appears to be dependent on the size of the electrode, the energy available from the apparatus, the method of application, the distance of electrodes from the skin, and the patient's tolerance. The data recorded in the accompanying figures are self-explanatory. Apparatus with wavelengths of 6 to 9 meters were used. Eight observations were obtained for the 9 meter and 6 observations for the 6 meter unit.

Figures 1 and 2 record the data for the anterior application of the 6 and 9 meter units, respectively. It is interesting to note that the temperature rises of the muscle are much greater for the 6 meter unit than for the 9 meter unit. However, in the opinion of the authors, this difference cannot be attributed to the wavelength.

Figures 3 and 4 show the lateral application of the air-spaced electrodes utilizing the electric field. Only two observations were taken and it is probably not justifiable to draw as definite conclusions as those from six observations. However, it is also noted that the muscle temperature rise and final temperature rise are greater with the 6 than with the 9 meter apparatus. An

Diameter of electrode, 5 in. Wavelength, 6 M±.
Electrode, skin distance, 1¼ in. Av. 6 observations.
Distance electrodes, center to center, 9 in. to 11 in.



Deep Muscle Temp. F.		Subcutaneous Temp. F.		Oral Temp. F.	
Init.	Final	Init.	Final	Init.	Final
98.9	106.6	97.4	105.2	98.7	99.1

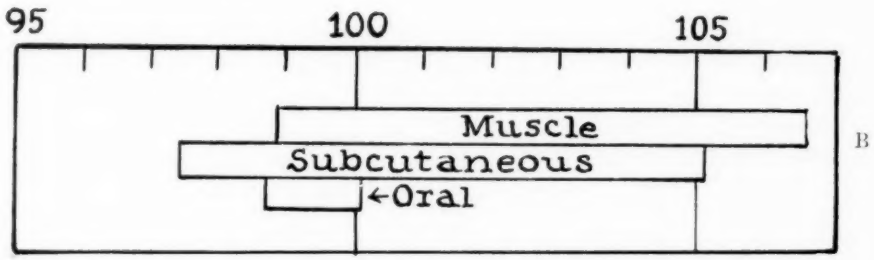
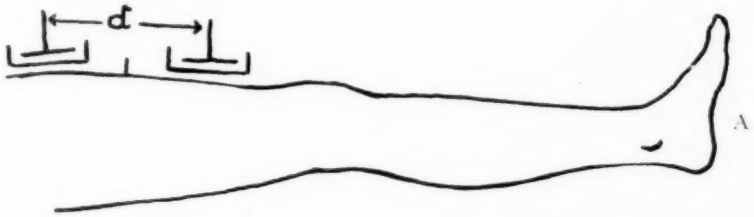


Fig. 1 (A and B). — Anterior application of air-spaced electrodes (electric field).

interesting point of comparison is the difference of heating between the results found in figures 4 and 5. In these two studies the lateral application was employed and the only difference between the two was the size of the electrodes. One electrode was 5 inches (fig. 4) and the other 7 inches

Diameter of electrode, 4 in. Wavelength, 9 M±.
Electrode, skin distance, 1¼ in. Av. 8 observations.
Distance electrodes, center to center, 9 in. to 11 in.



Deep Muscle Temp. F.		Subcutaneous Temp. F.		Oral Temp. F.	
Init.	Final	Init.	Final	Init.	Final
99.0	102.3	97.6	101.9	98.8	98.9

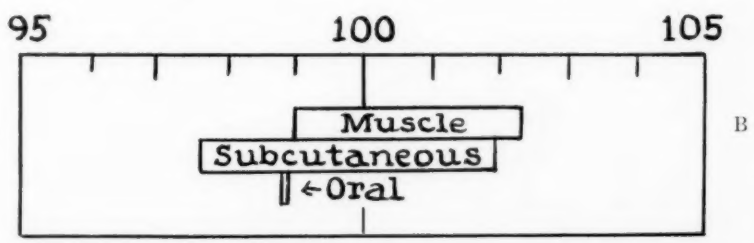
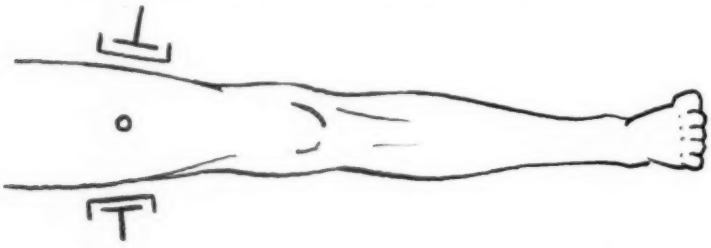


Fig. 2 (A and B). — Anterior application of air-spaced electrodes (electric field).

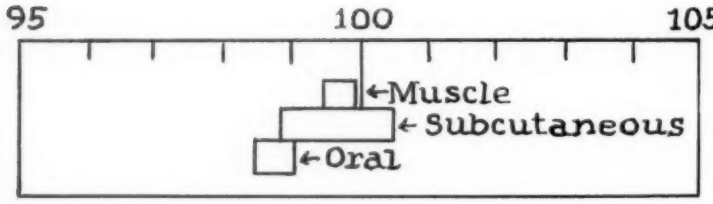
Diameter of electrode, 4 in.
Electrode, skin distance, 1½ in.

Wavelength, 9 M±.
Av. 2 observations.



A

Deep Muscle Temp. F.		Subcutaneous Temp. F.		Oral Temp. F.	
Init.	Final	Init.	Final	Init.	Final
99.4	99.9	98.8	100.5	98.5	99.1



B

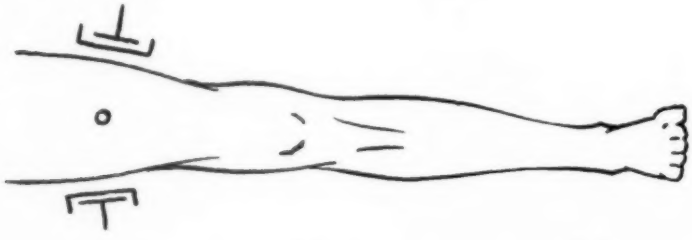
Fig. 3 (A and B). — Lateral application of air-spaced electrodes (electric field).

(fig. 5). The larger electrode produced the greater heating with the same wavelength.

Figures 6 and 7 represent a comparison of the heating effect of the posterior application of air-spaced electrodes of both the 6 meter and 9 meter units. It is obvious by comparing figures 6 and 7 with figures 1 and 2 that in

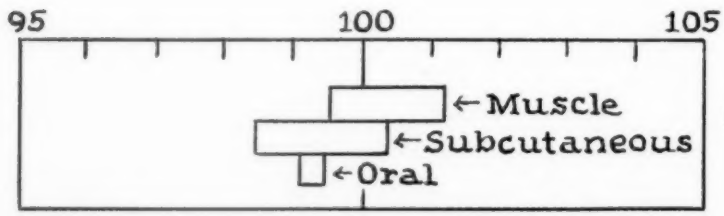
Diameter of electrode, 5 in.
Electrode, skin distance, 1¾ in.

Wavelength, 6 M±.
Av. 2 observations.



A

Deep Muscle Temp. F.		Subcutaneous Temp. F		Oral Temp. F.	
Init.	Final	Init.	Final	Init.	Final
99.6	101.2	98.4	100.3	99.1	99.4

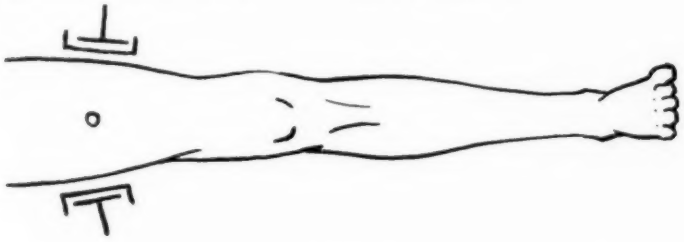


B

Fig. 4 (A and B). — Lateral application of air-spaced electrodes (electric field).

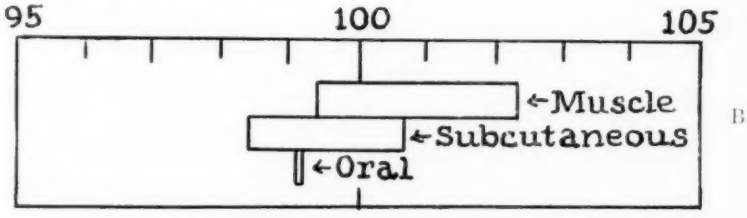
Diameter of electrode, 7 in.
Electrode, skin distance, 2 in.

Wavelength, 6 M±.
Av. 2 observations.



A

Deep Muscle Temp. F.		Subcutaneous Temp. F.		Oral Temp. F.	
Init.	Final	Init.	Final	Init.	Final
99.4	102.3	98.4	100.7	99.1	99.3



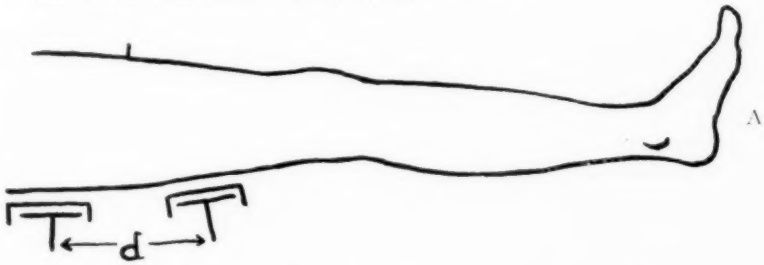
B

Fig. 5 (A and B). — Lateral application of air-spaced electrodes (electric field).

using air-spaced electrodes the method of application is most important. In heating the tissues of the human thigh by air-spaced electrodes the best method with the two tested wavelengths and three different sized air-spaced

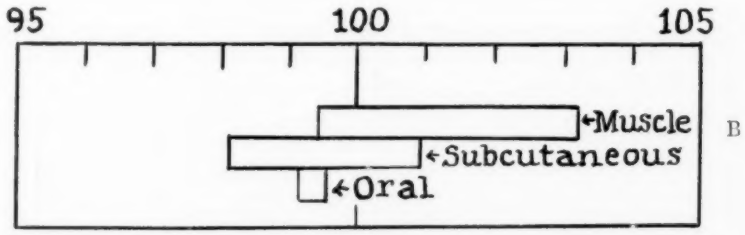
Diameter of electrode, 5 in.
Electrode, skin distance, 1½ in.
Electrode distance, center to center, 10½ in.

Wavelength, 6 M±.
Av. 2 observations.



A

Deep Muscle Temp. F.		Subcutaneous Temp. F.		Oral Temp. F.	
Init.	Final	Init.	Final	Init.	Final
99.4	103.2	98.1	100.9	99.2	99.5



B

Fig. 6 (A and B). — Posterior application of air-spaced electrodes (electric field).

Diameter of electrode, 4 in. Wavelength, 9 M±.
Electrode-skin distance, 1½ in. Av. 2 observations.
Electrode distance, center to center, 11 in.

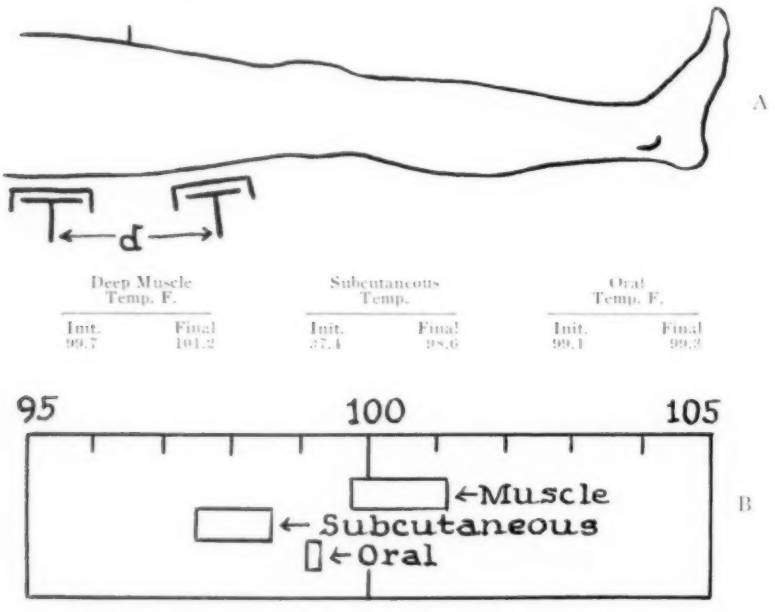


Fig. 7 (A and B). — Posterior application of air-spaced electrodes (electric field).

electrodes was with one electrode applied proximally and one distally to the part to be heated and on the same surface as the part to be treated.

Discussion

Before drawing conclusions, a discussion of the sources of error in the data seems advisable. The thermocouples used in the investigation were calibrated against a Bureau of Standards mercury thermometer. The potentiometer permitted accurate reading to within plus or minus one-fifth degree F. Placing of the cannula in the quadriceps extensor was accomplished without much chance of variation from time to time, but as much as several millimeters' variation in tissue of the several subjects was possible. Since the subcutaneous temperature readings are subject to changes due to depth, an error of plus or minus one-half degree may occur.

In the charts of comparison of wavelength, each average reading is an aggregate of at least six observations. The initial temperature readings may be subject to an error of observation of plus or minus one degree, but the lack of agreement with the norm of the final average temperature in each series was not so great. Hence, the final average temperatures are regarded as more significant than the initial or increment temperatures.

Although the runs were alternately arranged for several apparatus, the first run usually read a lower initial temperature. This initial reading usually below the norm was due to the surgical preparation, no doubt, such as washing with soap and rubbing with alcohol. The final temperature of each run on a patient was not subject to so great a variation from the norm.

The data for the application of air-spaced electrodes, both posterior and lateral, are averages of two observations each. Because of the expense, trouble and inconvenience and the fact that these data exhibited an unfavorable trend, only two runs each were made. The average of two observations

cannot be regarded as conclusive evidence, and no attempt is made to present it as such, but a definite trend is indicated.

In the opinion of the authors, the average of six observations of this kind are few enough to be regarded as satisfactory.

Conclusions

1. In the added studies with diverse wavelengths of short wave diathermy, it was observed that in heating live human muscle and fat there were no significant differences in the use of 6, 12, 15, 18 and 24 meter wavelengths when using the cuff technic of the electric field method, and no significant differences in the use of 12, 18, 24 and 25 meter wavelengths when using the coil technic of the electromagnetic field.

2. In the studies of tissue heating with air-spaced electrodes with the electric field the efficiency of heating is dependent on the size of the electrodes, the energy available from the apparatus, the method of application, the distance of the electrodes from the skin, and the patient's tolerance.

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(*For discussions turn to page 699*)

ULTRASHORT WAVE DIATHERMY IN PYOGENIC INFECTIONS *

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MILWAUKEE, WISCONSIN

Strides in physical medicine have not only been lengthened but also quickened by the introduction of physical means for the production of artificial fever; by the widespread use of apparatus in the management of injuries and diseases of the peripheral vascular system, and by the interest, world wide, in the utilization of ultrashort and short radio waves in the treatment of various pathologic processes.

Historically, Turrell has stated that "of recent years by far the most striking and valuable developments have resulted from d'Arsonval's great discovery of high frequency currents in 1888 and 1890. From the high frequency currents of tension (d'Arsonvalization) there have in turn developed the high frequency currents of quantity (diathermy) and the high frequency currents of resonance or capacity (short wave therapy). The last named, having regard to the polarization and high frequency orientation of the molecules may be popularly described as a molecular dance in which the molecules set to partners with considerable vigor fifty million times per second. The French school and the German school, the latter led by Schliephake and Esau, are carrying forward this work. In our country Schereschewsky, Kobak, Bierman and others have been the pioneers since 1926 and, more recently, the work of Coulter and Carter has been outstanding.

History repeats itself in the present controversy about short wave therapy. Wetzel and Kiesselbach have recently stated that in this method of therapy with its varying results, the heat produced by the conversion of electrical energy appears to produce the principal effect upon the tissues and this heat seems to represent the healing factor — an opinion presented by Dalchau, Hünermann, Raab and others. On the other hand, the opinion is also expressed by Schweitzer, Pflomm and, in a certain sense, also by Raab that other forces play a part in addition to the heating factor.

Regardless of the question of specific or non-specific effects, the promise of the value of this new form of therapy lies in the ability of introducing large quantities of thermal energy into the body without overheating the skin and subcutaneous fat. It appears possible to direct heat formation into any deep-seated part of the body. Whether or not there are any secondary physiologic benefits remains to be demonstrated.

We were familiar with artificial fever produced by 30 meter radio waves, and after exhaustive study of the world literature we felt free to begin clinical experimentation and since July, 1934, have given more than 7,700 treatments to 1,030 patients.

We are using four treatment units, one with an output of 200 to 600 watts, producing wavelengths varying from 3 to 15 meters and with a frequency of 20 to 100 million per second; three units with an output of 300 watts and a frequency of 50 million per second, producing 6 meter waves. These radio tube oscillator units from the standpoint of capacity, self-inductance, frequency and wavelength, oscillation starting, coupling, resonance and tuning, current and voltage, and maintenance were the best available.

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 10, 1936.

In the majority of treatments we use air-spaced glass condenser electrodes except where flexible rubber-covered electrodes seem indicated.

The electrodes are so spaced that the maximum heating sensation occurs in the lesion, care being taken that the patient feels only a sense of comfortable, pleasing warmth. In the treatment of suppurative infectious processes, in soft tissue infections and in post-traumatic injuries, the relief of local tension or pain is an excellent guide for proper field strength dosage.

Burns do occur if too strong a dosage is used or if perspiration is allowed to remain on the skin of the treated part. Early in our study we had three superficial vesicles appear upon the skin of the treated part. They healed readily and did not interfere with the daily treatments. It is just as objectionable to emphasize burns as a major complication in short wave therapy as it would be to avoid using x-ray facilities because of occasional burns. We have had none this last year and would ascribe any such accident to an error in technic.

With the institution of any new therapeutic measure is always carried the idea of indications and contraindications, especially when rays from the electromagnetic spectrum are in question. No injury to patients, other than "infrequent" burns and no injury to operators have been reported. Indications for ultrashort wave therapy must be learned as there is the natural tendency to treat too many conditions with a resultant waste of time and effort where simpler treatment has proved effective.

All of this leads directly to the controversy about nomenclature. Many maintain that diathermy and ultrashort wave therapy are dissimilar, while others claim that they are similar. Delherm and Cremer believe there is no difference between diathermy and short and ultrashort waves and consider that the term "d'Arsonvalization" should be applied to them both. One is forced to the conclusion that either ultrashort wave therapy is not diathermy or else that the contraindications to diathermy are ill founded.

Careful search of the literature has failed to find cases on record in which diathermic treatment has aggravated an inflammatory lesion, although there has been much hearsay evidence. As yet, I have been unable to find the name of the scientist who is alleged to have said that diathermy should not be used in acute inflammatory lesions. By this I do not imply that I advocate diathermy in such conditions, for my desire is merely to establish the origin of this contraindication.

Pyogenic Infections of the Face

Schliephake reported the first short wave treatment of humans when he treated himself for a nasal furuncle in March, 1929, in the University Medical Clinic at Jena. Recently Totten pointed out the potential danger of infections of the face, especially those of the upper lip, nose and cheek. The seriousness of the infection is increased by the pathologic character of the infection and by the anatomic arrangement of the facial veins. Uncontrolled infection may reach the cavernous sinus through the deep facial vein and pterygoid plexus or through the angular and superior ophthalmic veins; to the internal jugular vein through the common facial vein; and to the meninges by lymphatic extension. No definite treatment has been determined for these infections and the mortality is high — Gamble, reported 2 deaths out of 7 cases; Wright, 10 per cent mortality; Koslin, 6 deaths out of 18 cases; St. Luke's Hospital of New York (12 year period), 6 deaths out of 7, and Dettrich reported a mortality of 19.1 per cent of 40 cases. Melchior collected 73 cases, 37 were incised with four deaths and 36 were conservatively treated with one death. My thesis is that ultrashort wave therapy, properly applied, will assist in spontaneous resolution of these

lesions or so pronouncedly aid in the demarcation of these lesions that surgical incision can be performed without hazard.

There is no routine technic, for in each case individual treatment is indicated, guided by the sensation of the patient, the use of the neon bulb to determine the point of perfect resonance, and the performance of the apparatus. Experience has amply demonstrated that Schliephake is correct in stating that clinical judgment is the most important factor in ultrashort wave therapy.

Several illustrative cases are here detailed before presenting a statistical study of a large number of cases.

Case 1. — Peter, age 3, first seen when acutely ill with a suppurative discharging left parotitis and otitis media, May, 1933. X-ray radiation healed the lesion until recurrence in May, 1934. X-ray treatment was again instituted and the boy returned July 14, 1934, unimproved, the radiologist stating that he felt further x-ray dosage would be dangerous. The boy had a temperature of 103 degrees F., face flushed and free discharge of purulent material from the left parotid gland and left ear, with no mastoid tenderness.

July 14, 1934, he was treated 10 minutes with a 6 meter wavelength, using glass condenser electrodes to each parotid region, the left electrode being closer to the parotid than the right, with the following course:

July 16, 1934. Discharge less.
July 18. Discharge less.
July 19. Ear discharge has ceased.
July 21. Improved.
July 27. No discharge.
July 30. No discharge, parotid opening well healed with crust formation.
August 1, 1934. Well.
November 25, 1934. Slight recurrence with drainage — treated.
November 22. 1934. Treated — has remained entirely well.

Case 316. — Another illustrative case is that of Mrs. L., aged 36, referred by Dr. Carl Henry Davis, June 25, 1935, mother of a 6 weeks old child — with a new abscess forming in the lower right quadrant of her left breast. She was very uncomfortable, complained of constant disabling pain and had had two other abscesses in other quadrants of this breast incised within the previous month. Six meter wavelength treatment with glass electrodes, lateral to the breast, was given for 20 minutes. The analgesic effect of this one treatment was striking. Pain disappeared, she slept that night without medication and, following treatment the next day, was able to do her own work. This abscess completely resolved after seven daily treatments.

Case 221. — H., male, 38, referred March 13, 1935, by Dr. R. Warner, presented an unusual opportunity for study. Total blindness of the left eye, due to a central venous thrombosis (with late secondary glaucoma). He was under constant ophthalmologic observation for inevitable removal of the eye. He was treated by various wavelengths from 3 to 7 meters for study of the effect upon the eye. A narrow field was used and although 27 exposures were given, no heat effect was found on examination of the eye after its removal. Similar experiments must be performed in the future to determine the effect of ultrashort wave exposure upon the lens of a living eye.

Case 415. — Baby H., 4 months old, large abscess in left cheek, of unknown origin, seen September 21, 1935. Ten minutes, six meter, glass electrode treatment. The abscess opened spontaneously and drained freely the next day. Uneventful recovery with an excellent cosmetic result.

A typical history of a large group treated is:

Case 898. — John A., age 15, June 15, 1936, with history of having run a sliver into the left hand on June 12, 1936. Hand and epitrochlear gland were tender; red and painful lymphangiitis extending to left forearm. Following ultrashort wave treatment the tenderness disappeared. June 16th (next day) the lymphangiitis streaking became brownish in color and following treatment on the third day the boy was discharged cured.

In table 1 is presented the record of treatment of 38 cases of nasal furuncles during the last two years. The nose lends itself readily to treatment in the short wave field and it is not difficult by proper electrode air-spacing to produce the heat sensation in the furuncle itself, regardless of location. Twenty-eight of these cases were males, ten females; youngest age twenty, oldest patient seventy-three. The duration of the lesion before treatment varied from 1 to 21 days, the majority averaging 2 to 3 days.

TABLE 1.—*Treatment of 38 Cases of Nasal Furuncle by Ultrashort Waves*

Age	Sex	No. Days Before Treatment	Treat. at Which Resolution Occurred	Treat. at Which Spontaneous Drainage Occurred	Total Number Treatment	Remarks
60	F.	3 wks.	2	....	2	
27	M.	1 wk.	1	....	1	
40	M.	2 days	....	3	5	
45	M.	1 day	3	....	3	
25	F.	3 days	2	....	2	
27	F.	2 days	1	....	1	
27	M.	1 day	2	....	2	
53	M.	3 days	....	5	8	
45	M.	1 day	....	2	4	
27	M.	1 day	2	....	2	
25	M.	4 days	2	....	2	
27	M.	1 day	....	2	5	
44	M.	2 days	....	2	2	
23	F.	4 days	....	2	2	
27	M.	3 days	2	....	4	
53	M.	2 days	4	....	4	
53	M.	2 days	4	....	4	
28	F.	3 days	....	3	3	
45	M.	1 day	....	1	4	
73	M.	1 wk.	....	1	5	
44	M.	2 days	....	3	6	
25	F.	1 wk.	3	....	3	
40	M.	1 day	1	....	1	
45	M.	2 days	....	2	5	
36	M.	1 wk.	....	2	4	
23	M.	3 days	....	1	2	
54	M.	3 days	1	....	1	
45	M.	1 day	3	....	3	
26	F.	3 days	2	....	2	
24	M.	2 days	....	2	3	
26	M.	5 days	....	1	3	
70	F.	3 days	....	2	2	
40	M.	1 wk.	3	....	3	
35	F.	3 days	....	1	2	
40	M.	1 wk.	....	2	3	
53	M.	1 day	2	....	3	
56	M.	2 days	3	....	3	
22	F.	2 days	1	....	1	

Twenty cases presented complete resolution with treatment and 18 opened spontaneously and drained without surgical intervention. They were given 115 treatments which gave an average of three treatments per case, the lowest number of treatments being 1 and the highest number 8. Not one of these cases developed unsightly scar formation. This to me represents conservative treatment of nasal furuncles.

In table 2 is presented the record of 7 cases of upper lip infection. Four of the 7 were furuncles and two of the 7 had been traumatized before treatment by picking. The ages ran from 2½ months to 60 years, three males and four females; three underwent resolution and four drained spontaneously. The lowest number of treatments was 1 and the highest 9. Average per case was 3.8 treatments.

Table 3 presents the record of 32 patients with cheek infection, the majority being furuncles. There were 17 males, 15 females; duration of lesions before treatment ran from 1 day to 60 days, most of them were 2 to 3 days old; ages ranged from 4 months to 65 years. Five were draining before treatment, several had been traumatized, and one case discontinued treatment. Twelve resolved and 14 drained without surgical intervention following treatment. The average number of treatments was 2.5.

Table 4 is a record of 14 cases of chin infection. One patient did not come in from the country for treatment, but the remaining 13 cases were cured with an average of 3.5 treatments per case.

TABLE 2.—*Infections of Upper Lip Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treatment	Treat. at Which Resolution Occurred	Treat. at Which Spontaneous Drainage Occurred	Total Number Treatment	Remarks
45	F.	1 wk.	....	2	4	Furuncle on upper lip traumatized by picking
38	F.	1 day	1	....	1	Furuncle
60	M.	1 day	....	2	4	Furuncle
2½	M.	4 days	....	1	2	Furuncle
27	F.	2 days	....	1	3	Infected upper lip
35	M.	1 day	3	....	3	Large infected herpes simplex on upper lip
19	F.	2 wks.	9	....	9	Infected herpes simplex traumatized by picking

TABLE 3.—*Infections of the Cheek Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treatment	Treat. at Which Resolution Occurred	Treat. at Which Spontaneous Drainage Occurred	Total Number Treatment	Remarks
30	F.	3 days	....	2	2	Furuncle on left cheek
40	M.	1 wk.	3	....	3	Furuncle on right cheek
25	F.	4 days	2	....	2	Furuncle on right cheek
30	F.	1 wk.	....	2	5	Furuncle on right cheek
46	M.	2 days	....	1	3	Small Furuncle on cheek
4 Mo.	M.	4 days	....	1	1	Abscess on lower left cheek
65	F.	7 days	....	....	1	Large Furuncle — discontinued treatment
24	F.	3 days	2	....	2	Furuncle
30	F.	5 days	....	3	5	Furuncle on right cheek near temple
22	M.	2 days	....	D.O.A.*	1	Furuncle
40	M.	2 wks.	1	....	1	Furuncle on left cheek
35	M.	1 day	2	....	2	Furuncle on right cheek
50	M.	1 day	1	....	1	Furuncle on left cheek
30	F.	1 wk.	....	D.O.A.	2	Furuncle on right cheek
27	F.	1 mo.	....	1	4	Furuncle on right cheek
17	F.	3 days	2	....	2	Infected chicken pox pustule on left cheek
27	F.	1 wk.	....	D.O.A.	4	Furuncle on right cheek
52	F.	3 days	....	1	3	Furuncle on left cheek
42	M.	3 days	....	1	4	Furuncle on left cheek — headache
40	M.	1 day	....	3	5	Furuncle on right cheek
22	M.	1 day	2	....	2	Furuncle on left cheek
30	F.	2 days	1	....	1	Acute infection left cheek
37	M.	1 day	1	....	1	Furuncle on left cheek
26	F.	3 wks.	....	2	3	Cyst-like furuncle
36	M.	2 mo.	....	D.O.A.	3	Infected right cheek following dental extraction
36	M.	1 mo.	....	D.O.A.	4	"Gum Boil" on left lower cheek
46	M.	1 day	....	3	5	Small furuncle
30	M.	2 days	....	1	1	Cutting cheek with razor infected
30	F.	1 day	1	....	1	Acute infection on right lower side of cheek — sub-lingual
50	M.	1 wk.	2	....	2	Acute infection on right side of cheek and jaw
22	M.	4 days	....	2	2	Furuncle right lower cheek
32	F.	6 days	....	3	5	Furuncle right lower cheek traumatized by picking

* D.O.A.: Draining on admission.

Table 5 records the results of treatment of eyelid and eyebrow infections.

Table 6 lists 8 cases of furunculosis of the external auditory canal. Ultrashort wave diathermy is definitely indicated because of the ease of application of the electrodes and immediate relief of pain.

TABLE 4. — *Infections of the Chin Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treatment	Treat. at Which Resolution Occurred	Treat. at Which Spontaneous Drainage Occurred	Total Number Treatment	Remarks
40	F.	2 days	2	....	2	Furuncle
52	F.	1 day	....	3	4	Furuncle
27	F.	1 day	3	....	3	Furuncle
55	F.	5 days	....	....	1	Furuncle — very severe — discontinued treatment
30	F.	2 days	2	....	2	Furuncle
30	F.	2 days	2	....	2	Furuncle
40	F.	2 days	....	4	7	Large furuncle (portable)
16	F.	4 days	....	1	3	
27	F.	3 days	3	....	3	Furuncle
32	M.	1 day	....	2	3	Furuncle
13	M.	1 day	3	....	3	Small furuncle
34	F.	3 days	....	Incised (before admission)	4	Infection
50	M.	2 days	....	4	6	Infected chin from razor cut (incised)
60	M.	1 wk.	....	3	4	Infected chin from hair follicle

TABLE 5. — *Infections of the Eyebrow and Eyelids Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treat.	No. Resolved	No. Opened	No. Treat.	Remarks
18	F.	12 days	10	....	10	Infected burn on r. eyebrow and temple
35	M.	3 days	1	....	1	Sty
40	M.	2 days	1	....	1	Sty
22	M.	4 days	....	3	9	Furuncle on upper right eyelid (scarlet fever)
44	M.	3 wks.	....	1	3	Infection on upper eyelid
37	M.	1 day	4	....	4	Sty
37	M.	1 day	1	....	1	Sty
11	F.	3 days	3	....	3	Sty
35	M.	1 day	2	....	2	Sty
27	F.	3 days	....	1	2	Sty
28	F.	1 wk.	3	....	3	Furuncle on right eyebrow
30	F.	6 mo.	....	4	7	Cyst-like furuncle on eyelid. Incised and dilated to facilitate drainage.

Table 7 presents the results of our experience with axillary infection, noted for its obstinate refusal to heal promptly. By use of a special axillary glass electrode these patients ranging in age from 17 to 43 years, of whom 7 were females and 4 males, were treated 5.3 times per case before cure. The lesions had existed from one day to 4 months before ultrashort wave treatment. One of the 11 cases presented resolution in 3 treatments, but the remaining 10 cases opened and drained.

Table 8 represents a series of mammary infections that are particularly suited to treatment in the ultrashort wave field because of the ease of application of the condenser electrodes. Fifteen cases are reported, fourteen females, one male; age range from 24 to 44 years; 8 cases resolved, 5 drained without incision, one was draining on admission and one, a low grade mastitis, discontinued treatment the second day. Relief of pain was striking, demarcation of the infection rapid, and the cosmetic results in the cases that opened and drained were gratifying.

The following tables (9-15) list 141 cases of infections affecting other parts of the body. They consist of furuncles, boils, carbuncles involving the neck, leg, buttocks, arms, abdominal wall, vulvar and perianal regions. There were 11 cases of whitlow, most of these occuring among surgeons and

TABLE 6. — *External Auditory Canal Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treatment	Treat. at Which Resolution Occurred	Treat. at Which Spontaneous Drainage Occurred	Total Number Treatment	Remarks
30	F.	2 days	1	....	1	Abscess of right ear lobe cervical glands swollen
13	M.	3 days	1	....	1	Furuncle in left auditory canal
23	F.	2 days	....	1	2	Furuncle in right auditory canal
33	F.	3 days	3	....	6	Furuncles in both auditory canals
60	F.	4 days	....	2	4	Furuncle in right auditory canal
40	F.	2 days	....	1	2	Furuncle in left auditory canal
36	F.	1 day	....	2	11	Furuncles in both auditory canals
7	F.	1 day	1	....	1	Furuncle in left auditory canal
45	F.	Sev. yrs.	....	2	6	Chronic furunculosis in both auditory canals — no recurrence
26	M.	15 yrs.	No results		12	Post-scarlet fever otitis media

TABLE 7. — *Axillary Infection Treated with Ultrashort Waves*

Age	Sex	No. Days Before Treatment	Treat. at Which Resolution Occurred	Treat. at Which Spontaneous Drainage Occurred	Total Number Treatment	Remarks
38	F.	1 day	....	1	1	Right axilla
38	F.	5 days	....	3	3	Left axilla
38	F.	1 day	....	3	5	Left axilla — recurred
22	M.	3 days	....	1	3	Left axilla
32	M.	4 days	3	....	3	Left axilla
36	F.	4 mo.	....	1	4	Right axilla
30	F.	2 wks.	....	1	5	Left axilla
25	F.	4 days	....	1	1	Right axilla
17	M.	3 days	....	1	2	Right axilla
43	M.	2 wks.	....	2	10	Right axilla — kept recurring
42	F.	6 days	....	6	22	Right axilla — kept recurring

nurses, and cases of infections following injuries. These infections were treated in all stages, sometimes they were acute furuncles at the height of their development, other times they were just developing, or hard and non-purulent, with 15 of them draining when first admitted for treatment. Many were acutely ill showing headache, fever, and in about 20 per cent of these cases there was more or less lymphangiitis or regional adenitis.

The course of the disease varied according to the stage at which the patient came for treatment. If there is only an inflammatory effusion, and the furuncle is still small, the reddened top becomes sharply demarcated from the surroundings after the first radiation, and the center shrivels up and dries. On the following or third day there is only a reddish-brown superficial elevation, which disappears quickly, and the part treated can then no longer be distinguished from the surrounding structures.

The course differed when the furuncle had already become soft. In this case as a rule it opened very soon, very often during the radiation, frequently a few hours later, or during the following night. A large amount of pus was not discharged, but shortly afterwards the necrotic core was extruded. Then the discharge usually ceased, and this was followed by a remarkably speedy and complete cure, generally in two to three days. This

TABLE 8. — *Breast Infection Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treatment	Treat. at Which Resolution Occurred	Treat. at Which Spontaneous Drainage Occurred	Total Number Treatment	Remarks
25	F.	1 wk.	....	2	4	Furuncle — right
44	F.	3 days	2	....	2	Painful indurated mass in left breast
35	F.	10 yrs.	....	....	2	Mastitis — discontinued treatment
25	F.	3 days	....	4	8	Abscess — left
24	F.	3 wks.	7	....	7	Painful indurated mass in right breast, T. 100° F.
42	F.	1 wk.	2	....	2	Painful indurated mass in left breast
40	F.	2 days	....	3	8	Large abscess in right breast
25	F.	2 wks.	....	D.O.A.* (traumatized)	21	Abscess in right breast. Demarcation excellent but healing was slow.
36	F.	1 wk.	8	....	8	Painful indurated mass in left breast
32	F.	2 days	3	....	3	Abscess in left breast
36	F.	6 wks.	....	3	7	Abscess — nursing her infant
42	F.	1 wk.	12	....	12	Abscess in right breast
24	F.	1 yr.	6	....	6	Mastitis in left breast
35	F.	3 mo.	5	....	5	Cyst-like furuncle between breasts
40	M.	2 wks.	....	5	11	Furuncle on right breast

* D.O.A.: Draining on admission.

TABLE 9. — *Infections of the Neck Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treat.	No. Resolved	No. Drained Spontaneously	No. Treat.	Remarks
40	M.	4 days	....	2	2	Furuncle
20	M.	2 days	1	....	1	Small furuncle
32	M.	2 days	....	3	3	Furuncle
22	M.	6 wks.	6	....	6	Furuncles
40	M.	4 days	....	2	3	Furuncle
47	M.	3 days	....	1	2	Furuncle
30	M.	2 days	....	3	3	Furuncle
36	M.	4 days	1	....	1	Furuncle
22	M.	4 days	....	1	2	Furuncle
30	M.	1 wk.	....	D.O.A.*	1	Furuncle
32	M.	4 days	....	D.O.A.	5	Furuncle
40	M.	3 days	4	....	4	Furuncle
45	M.	1 wk.	....	3	5	Furuncle
32	M.	4 days	....	D.O.A.	2	Furuncle
13	M.	1 wk.	5	....	5	Furuncle
22	M.	3 days	....	1	1	Furuncle
22	M.	4 days	....	1	3	Furuncle
45	M.	3 days	....	1	2	Furuncle
19	M.	2 days	....	2	5	Furuncle
32	M.	2 wks.	....	D.O.A.	8	Carbuncle — opened by incision
45	F.	1 wk.	....	D.O.A.	12	Carbuncle
32	M.	1 wk.	....	1	8	Carbuncle — T. 99° F.
45	F.	2 days	....	3	5	Large carbuncle
18	M.	5 days	....	3	5	Carbuncle
18	M.	3 days	....	2	4	Carbuncle
42	F.	1 wk.	....	D.O.A.	13	Very large carbuncle
45	M.	4 days	....	2	7	Carbuncle
60	F.	1 wk.	....	3	4	Carbuncle
60	F.	1 wk.	4	....	4	Carbuncle
50	M.	1 wk.	....	4	6	Carbuncle
75	F.	1 wk.	....	....	5	Carbuncle
60	F.	1 wk.	....	....	10	Carbuncle
45	M.	2½ mo.	....	4	9	Infected hair follicle
45	M.	2 days	....	2	6	Infected hair follicle
22	M.	2 days	2	....	2	Infected hair follicle traumatized by picking

* D.O.A.: Draining on admission.

TABLE 10. — *Infections of Leg Treated by Ultrashort Waves* *

Age	Sex	No. Days Before Treat.	No. Resolved	No. Drained Spontaneously	No. Treat.	Remarks
30	M.	4 days	1	....	1	Acute infec. l. leg just below knee
55	M.	1 wk.	1	....	1	Acute infec. r. leg following a fall
8	F.	2 days	3	....	3	Furuncle on r. leg
4	F.	2 days	3	....	3	Furuncle on r. leg
20 mo.	M.	2 days	3	....	3	Acute infec. on l. leg from a scratch on brass ash tray T. 105° F.
35	F.	2 days	1	....	1	Acute infection following hypodermic inject.
40	M.	2 days	....	1	2	Furuncle—large—right thigh
27	M.	3 days	....	1	2	Large furuncle on thigh
32	M.	2 days	....	2	4	Small furuncle on thigh
4	F.	3 days	3	....	3	Furuncle on leg and thigh following insect bite
6	F.	3 days	....	1	3	Furuncle on leg and thigh following insect bite
4	F.	1 day	5	....	5	Furuncle — small —on l. leg following insect bite
3½	M.	3 days	2	....	2	Small furuncle r. leg
41	M.	3 days	....	4	7	Large carbuncle from infected hair follicle
8	F.	2 days	3	....	3	Furuncle on leg from insect bite
45	F.	4 days	....	1	5	Furuncle on thigh traumatized by picking

* 8 females and 8 males; 3½ yrs. to 55 yrs. 1 day to 1 wk. 10 resolved; 6 drained; 48 treat. 3.

TABLE 11. — *Infections of Abdomen Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treat.	No. Resolved	No. Drained Spontaneously	No. Treat.	Remarks
25	F.	5 days	....	2	4	Furuncle in coccygeal area
45	F.	3 days	....	4	6	Carbuncle on right side of buttocks
60	M.	3 days	....	1	1	Carbuncle on l. buttock
45	F.	2 days	7	....	7	Furuncle — large left buttock
17	M.	4 days	....	2	4	Carbuncle on buttocks
27	M.	3 days	....	2	3	Carbuncle — buttocks — left inguinal gland swollen
25	F.	2 days	....	1	1	Large furuncle left buttock
46	F.	3 days	....	opened bef. treatment	4	Large furuncle on buttocks
27	M.	3 days	....	3	3	Large furuncle on buttock — inguinal pain
40	F.	3 days	....	3	3	Large furuncle on buttocks
12	M.	1 wk.	....	1	3	Large furuncle on but. ing. pain
45	F.	1 wk.	....	4	5	Large furuncle — r. but.
27	M.	4 days	....	3	4	Large furuncle on but.
38	M.	1 wk.	....	1	5	Large furuncle on r. but. ing. gland swollen
25	F.	3 days	....	3	8	Acute infec. cyst on l. buttocks
30	M.	3 days	....	1	3	Large furuncle on buttocks
52	M.	2 days	....	4	5	Furuncle over coccyx
45	M.	3 days	....	2	12	Large carbuncle on but. near rectum
30	F.	1 wk.	....	D.O.A.*	3	Furuncle left side of buttocks near rectum
55	M.	3 wks.	....	5	11	Carbuncle in coccygeal area
30	M.	5 days	....	D.O.A.	3	Furuncle on abdomen
17	M.	3 days	....	1	2	Furuncle on abdomen

* D.O.A.: Draining on admission.

TABLE 12. — *Infections of Fingers Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treat.	No. Resolved	No. Drained Spontaneously	No. Treat.		Remarks
27	F.	1 wk.	1	....	1		Paronychia — index finger
32	F.	4 days	....	3	6		Paronychia — middle finger
25	F.	3 days	....	3	4		Paronychia — r. mid. finger
14	F.	1½ da.	1	....	1	*	Paronychia acute — l. mid. finger
34	F.	2 wks.	....	1	3		Paronychia — r. index finger
12	F.	3 days	1	....	1		Paronchyia — index finger right hand
40	M.	1 day	1	....	1		Paronychia — mid. finger right hand
30	F.	2 wks.	....	2 Dr. opened	3		Whitlow — r. index finger
32	F.	1 wk.	....	3 Dr. opened	3		Whitlow — l. mid finger
30	F.	3 days	....	1	1		Whitlow — l. ind. finger
40	F.	1 wk.	....	2	4		Whitlow — r. ind. finger
30	F.	1 wk.	....	3	3	†	Whitlow — r. mid. finger
46	F.	3 days	3	....	3		Whitlow — r. index finger
46	F.	1 wk.	....	2 Dr. opened	2		Whitlow — r. mid finger
26	M.	2 wks.	....	2	2		Whitlow — l. index finger
22	M.	1 wk.	....	1	1		Whitlow — r. mid. finger
45	M.	2 wks.	....	2	4		Whitlow — r. index finger
38	M.	5 days	3	....	3		Whitlow — r. index finger

* 12 to 40 yrs. 6 F. and 1 M. 4 resolved 3 drained spon. 17 treat. 2.4.
† 22 to 46 yrs. 7 F. and 4 M.; 2 resolved; 6 drained; 3 incised. 29 treat. 2.6.

TABLE 13. — *Infections of Arm Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treat.	No. Resolved	No. Drained Spontaneously	No. Treat.	Remarks
22	M.	3 days	....	3	4	Furuncle r. arm near wrist
23	M.	1 day	2	....	2	Furuncle left wrist
8	F.	2 days	1	....	1	Furuncle r. arm from insect bite
22	F.	2 days	....	2	2	Furuncle right arm
25	F.	1½ days	....	2	2	Furuncle r. upper arm
13	M.	1 wk.	....	D.O.A.*	2	Furuncle left elbow
40	M.	3 days	1	....	1	Furuncle r. hand from insect bite
30	F.	4 days	....	1	1	Furuncle, acute, left hand
50	M.	1 wk.	....	2	5	Furuncle l. arm near elbow from insect bite
30	F.	1 wk.	....	3	3	Furuncle left arm from insect bite
32	M.	1 wk.	....	3	4	Furuncle left hand from infected hair follicle
35	M.	1 wk.	....	1	1	Furuncle left hand near middle finger
40	M.	2½ da.	....	3	5	Furuncle on r. mid. finger
19	M.	1 wk.	....	2	5	Furuncle r. forearm
16	M.	2 days	....	1	1	Furuncle left arm
22	M.	3 days	....	3	5	Furuncle r. arm near elbow
22	M.	3 days	....	2	5	Furuncle l. arm near wrist
45	F.	3 days	....	2	2	Furuncle r. shoulder
40	M.	4 days	....	2	3	Carbuncle left elbow — lymphangiitis
28	M.	1 wk.	....	3	3	Carbuncle left arm
16	M.	3 days	....	D.O.A.	2	Carbuncle l. arm
16	M.	3 days	....	D.O.A.	2	Carbuncle l. arm near elbow
23	M.	1 wk.	....	D.O.A.	3	Furuncle — left shoulder
25	F.	3 wks.	3	....	3	Acute infection right mid. finger — cut finger on tin can
35	F.	4 days	....	1	1	Acute infection r. thumb — from fresh shrimp

(*Table 13 Continued on page 698*)

(*Table 13 Concluded*)

38	M.	1 wk.	....	1	3	Acute infection left hand insect bite
45	F.	4 days	....	3 Dr. opened	3	Acute infect. left index finger — ran wire under
22	M.	3 days	....	2	3	Acute infection — 3rd finger left hand following a cut
26	M.	6 wks.	3	....	3	Reaction — thorn in finger
44	M.	3 days	1	....	1	Acute infection 3rd left finger, from splinter
45	F.	2 days	....	2	4	Acute infection left index finger from thorn
27	M.	3 days	....	3	7	Acute infection on left thumb — punctured wound while embalming corpse
35	F.	6 days	3	....	3	Acute infection on r. index finger after puncture wound
30	M.	2 wks.	4	....	4	Acute infection — dorsum of l. hand — lymphangiitis l. arm. T. 101° F.
42	M.	2 wks.	....	2	3	Acute infection. Fishbone puncture of r. ind. fing.
40	F.	4 days	1	....	1	Acute infect.; bumped l. 3rd finger
45	F.	4 days	2	....	2	Acute infection after hypodermic injection on right arm.
22	M.	1 wk.	....	2	5	Acute infection — ran nail in palm of r. hand
15	M.	3 days	3	....	3	Epitrochlear — ran splinter in l. hand
38	M.	1 day	1	....	1	Small vesicular infect. right hand
36	M.	5 days	6	....	6	Infected hair follicle lymphangiitis T. 99.2° F.

* D.O.A.: Draining on admission.

TABLE 14. — *Infections (Special) of Toe Treated by Ultrashort Waves*

Age	Sex	No. Days Before Treat.	No. Resolved	No. Opened	No. Treat.	Remarks
45	M.	3 wks.	2	....	2	Infected corn on right foot small toe
35	M.	1 day	1	....	1	Acute infection on left foot second toe
27	F.	2 wks.	2	....	2	Acute infection on big toe. (Diabetic)
50	F.	1 wk.	2	....	3	Acute infection in left foot
47	M.	4 days	3	(swelling down)	4	Infected dorsum of foot following a razor injury
30	F.	3 days	....	1	3	Cut toe with razor. Infected
50	F.	1 wk.	3	....	4	Acute infection. Corn on left foot small toe
20	M.	3 days	4	....	4	"Blister" formation from tight shoe, infected
75	F.	10 days	....	D.O.A.*	4	Infected toe. (Diabetic)
40	M.	6 wks.	2	....	2	Acute infection. Scissors fell on foot

* D.O.A.: Draining on admission.

TABLE 15. — *Furuncles, Miscellaneous*

Age	Sex	No. Days Before Treatment	Treat. at Which Resolution Occurred	Treat. at Which Spontaneous Drainage Occurred	Total Number Treatment	Remarks
36	F.	2 wks.	....	incised	2	Furuncle
35	F.	4 mo.	....	1	10	Cyst-like furuncle
55	F.	3 wks.	....	1	3	Furuncle

same course followed essentially after treatment of every inflammatory focus by short waves. In fresh effusions, absorption, and in older cases demarcation and resolution, were hastened.

It may be remarked that the field must not be made too strong during treatment. One should only proceed while a pleasant warmth with relief of tension is felt. If stronger fields are used the focus is cured, but heat coagulation will occur, which soon becomes apparent in the reddish-blue discoloration of the furuncle and its surroundings. The healing then usually takes longer, often eight to ten days.

The appearance of the involved area, particularly in those cases in which the carbuncles were extensive, frequently involving the entire neck, was excellent in all cases after treatment was completed. In no case did we encounter any unsightly scar formation.

Conclusions

1. Ultrashort wave diathermy can be used in the treatment of inflammatory or suppurative infectious processes at any stage of the lesions.

2. This therapy, properly applied, is of distinct value in localizing infectious lesions. It will cause resolution of such processes in the majority of cases; in many it has produced sharp demarcation and spontaneous drainage without surgical intervention.

3. In those cases in which for various reasons surgical intervention is indicated, ultrashort wave therapy so effectively localizes the lesion that the surgeon is permitted to operate at an earlier time with distinctly less surgical hazard.

4. Ultrashort wave diathermy is conservative therapy.

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Discussions of Drs. Coulter, Osborne's, and Egan's Papers

Dr. William Bierman (New York): There is no doubt that it is possible to elevate the temperature of tissues by means of short wave current. The question of any effect other than heating is still a moot one. There is, undoubtedly, a selective effect, but it is selective in the sense of heating, depending upon concentration of solutions, particularly outside the body. Inside the body we have the heat leveling influence of the circulation. There is one interesting effect of the short wave current which should be emphasized and that is the ability of the current to create more or less homogeneous heating through different types of tissues. In contrast to diathermy, short waves have capacitive in addition to ohmic effects, which makes it possible for the more homogeneous heating to take place. Accordingly tissues of different densities show the temperatures to be pretty much the same.

As to the special effects upon pyogenic infections, that is another moot question. It is my opinion that it is possible to explain all the effects upon the basis of heat produced, and there we ought to pay attention to something which I consider very important. That is the question of heat dosage. It is possible to create too much heat in an area just as it is pos-

sible to create too little heat. It is axiomatic that we should have some idea of this question of heat dosage. The damage reported such as burns, increased pain and other untoward effects is due to treatments lacking the criterion of exact dosage.

If we conceive of short wave application as a heat effect, we really are in a much better position to apply that current clinically. The lateral plate technic to which Dr. Coulter has called your attention, has been used for a goodly number of years. During this past year we created temperature elevations of the entire body using a technic of that type, with the ordinary accepted short wave apparatus on the market. We found it easy to elevate the temperature of the entire body to 105 degrees in about an hour. The lateral technic is good because it brings into play something which has been called attention to by previous workers. If the size of the condenser electrode is relatively large in comparison with the cross diameter of the region, the lines of force tend to converge and with that concentration one obtains greater heating effect than with the lateral plate technic.

Dr. Edward Horowitz (New York): I was especially interested in Coulter's references to pelvic heating by short wave currents. During the past year at Beth Israel Hospital, a study of purely local heating by short wave apparatus was undertaken in conjunction with our physicist, Myron Schwarzschild and Drs. Gottesman and Derow. Nine different apparatus of varying wavelengths were used. The first method of application by externally placed condenser plates with thermometers within the rectum and vagina, failed to demonstrate any considerable degree of internal heating. The highest internal temperature during such treatment was about 102 degrees F. and this patient was rather uncomfortable because of the high degree of heating of the skin under the condenser plates. We varied this technic by placing the condenser plates laterally on each side of the body, on each side of the pelvis, and again the degree of temperature elevation was rather small, no more than 102 or 102½ degrees. These results agree with those of Dr. Coulter and others.

At the suggestion of our physicist we adopted the method which had previously been used by Dr. Bierman in conjunction with the radiotherm, namely, the pick-up plate, and with this device we used bare metal electrodes in the vagina as for ordinary diathermy. The important finding was a considerable degree of temperature elevation in the vagina, cervix, rectum and bladder. Temperatures between 106 and 107 degrees could be maintained in these parts during treatments of 30 to 45 minutes' duration. In addition, the bladder urine was heated. We found no specific effect due to wavelength. The effects were purely those of heating due to the proximity of the electrode to the treated areas.

Dr. Samuel Gottesman (New York): Not satisfied with the method that was supplied by manufacturers of different apparatus we began about fourteen months ago a study of the different procedures of applying short waves. We studied a number of cases and the highest temperature we were able to obtain in the vagina was about 102 degrees F. We found temperatures of 111 and 112 underneath that electrode, and in some cases we got burns, and discomfort in all. The same held true with the side to side electrode. We also tried it by cuffs around the two legs applied to both legs with a belt around the abdomen. The same held true there, too. We only got temperatures of about 102 degrees F.

We then applied one electrode to the abdomen and the other one, a glass electrode to the orifice. By this method we were able to obtain a temperature of about 105 degrees in the vagina, but the discomfort to the patient was so extreme we could never maintain it for more than about ten minutes and had to reduce it to about 102 degrees to continue. We also got quite a number of minute burns with this electrode. We then went to the next step.

We took the same bare metal electrode, as in diathermy treatment. That was originally made by Dr. Horowitz and myself. We used that together with the tap-off. We therefore have a metal electrode between the two other ones — the abdominal and tap-off. The inactive electrode we applied on the abdomen. With this method we were able to obtain quite a good deal of heat, but the output of the apparatus was usually too low to give us more than about 105 to 106 degrees.

We then, also found it would be very hard to use the same method on different machines since with each one we had to vary the size of the electrodes, length of the cords and also distance between the two. The variable condenser had to be used between the machine and the electrode. The variable condenser had to be about the same distance from the machine as an ordinary cord is toward the electrode. The indifferent electrode was applied to the abdomen. By this method we were able to obtain much higher temperatures than before.

Another way is that instead of using the electrode on the abdomen to place it under the table. It will only work with very low wavelength apparatus, about 6 to 9 meters at the most. With other machines you have to have it nearer to the patient. We began studying means of securing more current from the same machine. By cutting the cords to a certain length, we found with the 6-meter machine we were able with a twenty-three-inch cord to get a maximum output. We apply the short cord to the active electrode and the indifferent electrode either on the abdomen with the long wave machines or under the table with the 6-meter apparatus. Our last work has been with this method and we find that we are

able to obtain temperatures from 109 to 112 degrees.

The maximum temperature is obtained about ten minutes after we start treatment. Then the temperature begins dropping and we have to have quite a reserve in the machine to be able to step it up in order to maintain the desired temperature. That is our last method. The last number of treatments showed much higher temperatures by this procedure. The only disadvantage is that the cord is so short in some cases we are unable to bring the patient near enough to the machine to be able to give that treatment. Therefore, we have as our last resort asked the manufacturers to build a machine that will fit under the table so we can bring our cord through the table. We expect to report in the near future on a comparison between the short wave and the diathermy treatment in pelvic conditions.

Dr. Heinrich Wolf (New York): I would like to make certain remarks which do not exactly coincide with the views of Dr. Coulter, and to point to some reports in the literature which present an opposite view. In the first place, Pflomm and Liebesny report that in treating a frog heart with short waves, they have been able to reduce the heart beat in spite of the use of a heating short wave, while ordinarily heat increased it. It has been shown that short waves have an inhibitory influence on the activity of the thyroid gland, and though there was obtained more thyroid secretion in the blood after the treatment, that was due to an increased drainage of the gland and not to an increased amount of production.

Hasché has pointed out that the short wave field is not as homogeneous as is believed. He showed that there are certain eddy currents produced around the electrodes and he bases even a special theory of the effect that by using short waves he does not direct the electrons in one direction, but somehow produces an increased reaction just as we would when we use heat in chemical experiments.

It is perfectly true that Malov has shown that the fruit fly is killed by the heat. He mentions the fact that it is not necessary to use another explanation, but after all he only kills the fruit fly and does not show how it in reality acts. This certainly has to be considered because it is impossible that short waves may have the effect of heating up the tissue and still have another form of action.

I would call your attention to the fact that for instance, ultraviolet rays around 3,000 AU. produce an erythema effect and at the same time increase the calcium metabolism. We know that erythema effect has nothing to do with change of calcium metabolism. Theoretically, it is certainly possible that the short waves have another effect besides heat. I am inclined to question the reports of Weissenberg that he uses short waves of only one watt and obtains results from it. If he treats paresis with success, we know perfectly well his technic would never attack the process, and certainly it hasn't the effect that he claims. If he draws attenion to Americans who use 30 meter waves for the treatment of paresis, the Germans obviously do not realize we use that method for increasing the body temperature, and we can obtain the same by other methods, and that it is not short wave per se we use for paresis, but heat.

There is some circumstantial evidence that there must be some difference in the action outside of heat. Dr. Egan has pointed out that only a small amount of energy can be and should be used in infectious conditions. If that is so, it is quite obvious that the current does not kill the organism, does not act in bactericidal fashion, but through some other way.

Eidinow has made some experiments on that basis and showed they have no bactericidal effect. But we do not need these experiments. We make them every day and Dr. Egan has shown you some of them. He has shown you that cases of furuncles when treated early become completely absorbed and we all can corroborate that statement, but in the later stage an abscess is formed and must be drained. If heat were bactericidal, isn't it obvious this organism would be killed, whether in an abscess or in the tissue? I believe that a very important point. The heat, itself, is too low to have any really therapeutic effect.

Dr. Egan spoke of the fact that diathermy and short waves work in the same way. I cannot agree to that completely, because if it were so, we are using diathermy since the year 1907 and we have always been warned that diathermy in acute inflammatory condition increases the pain and brings about necrosis in the tissue.

I have tried to establish a theory for that. If you have an inflammatory process you have *rubor*, *tumor* and *calor*. What is that due to? It is obviously due to the fact that edema develops around that process. This edema interferes considerably with the local circulation and, as a result we get necrosis, abscess inside, because the tissue is not sufficiently nourished. How is that? It is not nourished sufficiently in spite of the redness because we have obviously an increased arterial blood supply, but we also have a considerably decreased venous outflow. So, if we use diathermy we will increase the difficulties of circulation and break down tissue.

On the contrary, Pflomm has shown in some very interesting experiments on the frog that he can dilate the capillaries of this organ to such an extent that this dilatation persists for two weeks. The result of that must be that there is an improved circulation and of the entire circulation, affluent as well as effluent.

By dilating the arteries we do not do any harm, because we improve the outflow by the dilatation of the capillaries and of the lymph vessels. In doing so

we bring into the tissue the defensive substances of the body. It also has been shown that through mild diathermy we increase phagocytosis.

Though I do not want to contradict what Dr. Coulter has said because what he has said is correct, however, the conclusions he has drawn are certainly, to my mind, not convincing.

Dr. Tibor de Cholnoky (New York): I am glad to hear that Dr. Egan confirmed those results which he published in the last year in ARCHIVES OF PHYSICAL THERAPY. Short wave therapy is valuable in infective processes with infiltration. If the infiltration is not so far advanced that there is abscess formation, by short wave therapy the process may be reversed and resolution take place. That explains how and why such quick results can be obtained by short wave therapy. If there is abscess formation and fluctuation, surgical intervention is still indicated, so it does not mean that by the introduction of short wave therapy surgery will be eliminated.

As we heard from Dr. Bierman, it is possible to overtreat lesions. But though the healing process is delayed, it still takes place without any disturbances. Another point which I would like to emphasize is the use of short wave in infections in diabetics. We found that in diabetic furuncles and carbuncles the healing process is greatly quickened and the results are uniformly good. Naturally, the blood and urine tests should be made and the diabetic condition controlled.

We also conducted experimentation on cancer under the direction of Dr. Francis Carter Wood. Naturally, we treated only enucleable sarcomas and carcinomas, and we found that with waves between 3 and 5 meters the destruction was the greatest, but with a few exceptions in a great series, we could not find and could not agree with foreign authors and research workers that cancer cannot be cured. What we found by histologic examination, the same as we find with electrocoagulation, is heat effect and purely coagulating effect. We also applied it on inoperable cases of human carcinoma, in combination with other therapeutic measures, but we could not find any beneficial results.

Dr. Frank Woodbury (Poughkeepsie, N. Y.): With diathermy we naturally think of heat only. If we use a thermocouple we are testing for heat. However, I should like to know something about the hydrogen ion changes in the blood, something about cholesterol relation of potassium and calcium in the blood, and various other laboratory findings following short wave treatments.

The whole question whether there is any specificity connected with short wave therapy is partly answered by Dr. Egan, in that he gets certain peculiar effects with short wave in suppurative processes that he does not get by heat in any other way. Therefore, there must be some specificity in a particular wavelength which is not connected with heat per se.

A very simple test can be made by anybody with a short wave apparatus. That is to use a certain wavelength but not to use it strong enough to raise the temperature of the part, and then see the result. You will then have a subthermal or infrathermal radiation, weak, it is true, if you are looking at it from the standpoint of heat, but still with resonance and still absorbable by the tissues. I happen to have a small, weak apparatus I am working with and am not prepared yet to make any reports because I have not sufficient data, but I can say that with 15 watts and 300 milliamperes and a 4-meter wave, I have been able to stop absolutely in twenty-four hours two dental abscesses that had large gum boils, without any other treatment whatsoever, two treatments given at twenty minutes each, twelve hours apart.

I have also been able to see some large facial acne and pustules disappear by giving a treatment for arthritis of the knee which struck me as very interesting, particularly as the patient had been treated for some time by a dermatologist. He had used various treatments which had improved from time to time, but the condition returned and disappeared, and at least for three or four weeks after I had finished my own treatment the face was still clear of these infections.

So if anybody wants to find out whether there is any specificity in short wave radiation unconnected with heat, let him use such low intensities as not to produce heat in the tissues and then he will solve the problem to his own satisfaction.

Dr. A. R. Hollender (Chicago): Before we concern ourselves too much with the specificity of short wave diathermy, we should be certain of its therapeutic value in conditions other than furuncles. While it is conceded that pyogenic infections respond more promptly than with the customary procedures, the scope of indications must be widened before we can make a positive appraisal of this newer treatment.

There is no doubt that short wave diathermy is a meritorious measure in acute inflammatory and infectious processes. Its analgesic properties cannot be denied. In various conditions about the head and neck experience has demonstrated that we can relieve pain, promote drainage and hasten an end-result that would otherwise be protracted. To say, however, that surgery is always avoided by the employment of short wave diathermy, is in my opinion an exaggeration. We are led to assume from the reports of European workers that surgery is frequently obviated in acute infectious processes, but such claim has not been borne out by the experience of workers in this country. I have reference to such conditions as sinusitis and otitis media, which while aided in prompter resolution when uncomplicated, still frequently require surgical intervention. Short wave diathermy proves as valuable postoperatively as preoperatively, so that its status remains uninfluenced as a therapeutic adjuvant.

In the chronic involvements short wave diathermy has not proved superior to conventional diathermy. In fact the latter still holds first place with me for a variety of chronic conditions. Until our methods of ap-

plication are improved by suitable electrodes, conventional diathermy will continue to be a useful procedure in chronic infections about the head.

I wish to take issue with the essayist that controls are unnecessary in the experimental work which he has conducted. Controls render one's results more acceptable. Certainly had Dr. Egan supported his results with proper controls there could be no controversy. In view of the absence of controls the evidence presented is questioned in so far as one has no comparisons with the results obtainable with other procedures.

In conclusion, permit me to caution against overenthusiasm. Short wave diathermy is passing through the same stages of development as conventional diathermy. Our experiences with the latter should enable us to avoid many of the contingencies which always interfere with any innovation in medicine. I see in short wave diathermy unlimited possibilities, but until we can prove our ground, we should move slowly. At present we can claim for it no more than we can for conventional diathermy — heat — which, however, penetrates deeper into the parts. Its superiority, aside from this fact, lies in its facility of application.

Dr. C. G. Buckmaster (White Plains, N. Y.): I should like to ask Dr. Egan if he has had any experience in the treatment of ringworm with the 6 meter field, and in his application to the female breast did he take a quarter exposure at each side of the breast or go right through?

He spoke about the length of treatment. We have been using fifteen minutes. If ten minutes is better, I wish he would make that clear because I do not like to spend fifteen minutes if ten will do. I have only used a 6 meter current for about one year, but I have found in that time that I cannot give it very well to people who have tremor.

I should also like to ask what his experience has been in that line, whether or not people who have tremor can take short wave therapy?

Dr. W. J. Egan (closing): I was with Dr. Schliephake in London in May. He uses the lateral plate method a great deal. In fact, for arthritic cases he has them lie on a non-metal cot using two large electrodes laterally placed, as Dr. Coulter demonstrated, using a 12 meter water cooling apparatus. He has no conclusions about it and is waiting to report on it.

I want to state how important to us as clinicians the work of Dr. Coulter and Mr. Carter has been. We are not at all sure what the effect of this field is. A physicist can very accurately arrive at the point which is most effective. Work of that type will help us a great deal in the proper clinical application of electrodes.

I have emphasized in my paper that overdosage is dangerous. On the other hand I try to arrive at the answer why in so many cases the skin looks well after treatment. I am beginning to believe the more I see of the old-fashioned treatment that the bad results and scars from deep-seated carbuncles on necks are due more to an improperly applied compress or poultice than anything else.

In regard to what Dr. Wolf stated I confirm the speaker's remarks and they are in my charts on the efficacy of short wave therapy in diabetic infection, furuncles, infected toes, and the like.

I take Dr. Hollender's criticism with a certain amount of reservation because I have based my report on over 7,000 treatments of over 1,000 patients. As a faculty member of a recognized medical school on which I have served with no blemish to its reputation, I feel that I am warranted in stating that my conservatism is as much unquestioned as is my progressiveness. The report submitted is based on critical observations and painstaking analysis. I cannot agree with Dr. Hollender that ultrashort waves possess a special effect on acute infective processes — a sort of specific effect — and an inferior effect on chronic conditions. I shall read with interest his first published report on his experience with short waves in the otolaryngologic specialty, and especially the technic he used which makes him consider diathermy superior in chronic conditions. I think I am in agreement with the best teachings in medicine when I say that furuncles about the nose and lips are the most malignant types of infection encountered. Ultrashort waves offer a safer and less mutilating procedure than surgery.

We have not treated any ringworms. Breasts we treat fifteen to twenty minutes. We try to gauge it by clinical experience or clinical impressions and they are worth just that. We treat a small furuncle on the nose five or six minutes; a larger furuncle on the nose or face, ten minutes; breast, fifteen or twenty minutes. We formerly treated breast cases twenty-five minutes, but felt the results were better with twenty.

VITAMIN D AND FEVER THERAPY IN CHRONIC ARTHRITIS

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Based upon the observations of Dreyer and Reed[1] in the treatment of atrophic, hyperatrophic and specific arthritis by means of massive doses of vitamin D, we undertook to corroborate the effectiveness of this new form of therapy.

Method of Treatment

Our cases were divided into two general groups; namely, (1) those treated with concentrated Vitamin D* only; and (2) those treated with concentrated Vitamin D plus fever therapy.

Vitamin D concentrate was given in dosages varying from 200,000 to 600,000 U. S. P. or International units daily. Each capsule of the particular preparation used contained 50,000 U. S. P. or International units. The administration of this drug was continued over an indefinite period of time. Clinical improvement, which may not be evident for from one to three months, was gradual until maximum benefit was reached in each case. This point of maximum benefit was variable in time and degree of improvement.

Fever therapy was given weekly, each seance for a period of eight hours. The body temperature, by means of a short wave induction coil and cabinet arrangement was "built up" over a period of about two hours to 102-103 degrees F., at which time the inductotherm was discontinued. The cabinet maintained this systemic temperature during the remaining period. At no time was the temperature of the circulating air in the box allowed to exceed 100 degrees F. This relatively lower temperature of the air surrounding the patient as compared to the systemic temperature allowed comparative comfort during the period of hyperpyrexia.

The patient was prepared on the morning of treatment by an s. s. enema. The usual breakfast was allowed. Bromides were given as indicated. In severe cases to allay pain, codeine or morphine were given. Spiritus frumenti was given every three to six hours during the period of hyperpyrexia.

Following the eight hour period, the patient was removed from the cabinet to a table, where a sponge bath and alcohol rub were given. It has been found necessary to allow the patient to remain in bed for from twelve to twenty-four hours after each fever treatment. A regular hospital diet was allowed without reference to special carbohydrate or protein variations.

Results. — Progressive improvement has been noted in from one week to two months of treatment. The improvement was manifested by decreased pain, greater mobility, reduction of deformity, and improved muscular tone associated with increased muscular strength. The general state of health was improved. The depressed mental attitude of most of these patients was changed to that of hopefulness. The appetite returned.

Laboratory Findings. — There was no appreciable change in the blood chemistry. Blood calcium and phosphorus remained within normal limits. There was no increase in the output through the urine of calcium or phosphorus. The sedimentation rate in all cases remained decreased. There was no change in the red blood cell count or in the differential. The leukocyte count was not altered. In all cases the Schilling test shifted to the right.

* The Vitamin D preparation used in these studies was Ertron.

Toxicity. — The question of permanent injury to the liver or other organs from prolonged administration of large doses of Vitamin D naturally arises. Early symptoms of toxicity are evident to the physician and patient, and when they appear the drug should be discontinued at once for a period of two weeks, after which time it may be resumed without untoward effects. The early symptoms of overdosage are persistent nausea, increased frequency of urination, lassitude, anorexia, polydipsia, diarrhea, severe gastrointestinal pain, and vomiting.

It has been reported that brewers' yeast will allay the discomfort incident to toxicity. In my experience this has not been the case. It is, in my opinion, better to discontinue the drug immediately for a period of two weeks. Toxicity is not associated with hypercalcemia.

Discussion

It is difficult to evaluate the results of any form of therapy in arthritis because of the multiple manifestations of the disease with its associated complications. The response of any given case cannot, therefore, be predicted. In cases showing benefit, however, there was a general improvement in the nutrition, less evidence of vasomotor instability, lessened pain, increased mobility and reduction of edema.

The mechanism of clinical improvement is not understood at this time. It may be assumed that non-specific arthritis is associated, in part at least, with a vitamin deficiency. This is not felt, however, to be the whole picture but purely one of the complicating factors. It is, therefore, believed that vitamin D should be used in combination with the various other known methods of treatment, especially fever therapy. It was noted in comparing table 1 with table 2, that when vitamin D was combined with fever therapy, clinical improvement was more rapid than when vitamin D alone was used. From the observations made in this series, there is no contraindication to vitamin D or fever therapy, so far as is known at this time. Cases with vasomotor instability and complicating heart lesions, such as rheumatic heart, moderate myocardial degeneration and fibrillation, were included among the cases in table 2, and were treated without untoward effects and with improvement.

TABLE 1. — *Vitamin D Only*

Type	No. Cases	Clinical Improvement	No Clinical Improvement
Atrophic, infectious or rheumatoid arthritis	5	4	1
Hypertrophic or metabolic arthritis	3	2	1
	8	6	2

TABLE 2. — *Vitamin D Plus Fever Therapy*

Type	No. Cases	Clinical Improvement	No Clinical Improvement
Atrophic, infectious or rheumatoid arthritis	9	8	1
Hypertrophic or metabolic arthritis	4	4	0
Specific arthritis (Gonorrheal)	1	1	0
	14	13	1

Summary

1. Twenty-two cases of severe arthritis of various types have been treated with vitamin D only or with vitamin D plus fever therapy.

2. Nineteen of these cases showed clinical improvement; one case dis-

continued the treatment; and two cases showed no improvement.

3. Former observations revealed that fever therapy alone was not effective.

4. Fever therapy when employed in conjunction with vitamin D caused more rapid clinical improvement than vitamin D alone.

5. When toxic symptoms appear, the drug should be discontinued at once for two weeks.

6. So far as could be observed at this time, there is no contraindication to this form of therapy.

7. The blood chemistry and blood picture remain within normal limits with the exception of a decreased sedimentation rate and a shift in the Schilling test toward the right.

8. Arthritis is, probably, associated in part with a vitamin D deficiency.

9. The mechanism of this therapy is not understood.

Reference

1. Dreyer, Irving, and Reed, C. I.: The Treatment of Arthritis with Massive Doses of Vitamin D, Arch. Phys. Therap., X-Ray, Rad. **16**:537 (Sept.) 1935.

MEDICAL DIATHERMY IN RECTAL STRICTURE *

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It is now well established that the vast majority of benign strictures of the rectum are either the result of simple inflammatory processes or of lymphogranuloma inguinale, a better term for which is lymphopathia venerea, since it is a venereal disease. Gonorrhea and syphilis are now only considered of questionable etiologic significance in rectal stricture. A few are due to trauma, as in labor and a few are postoperative, usually involving the lower rectum and anal canal. Strictures from x-ray burns are advisedly not treated by diathermy.

It is worthy of note that purely inflammatory strictures are more apt to involve only the lower rectum while those associated with lymphopathia venerea usually extend up to the peritoneal reflection or higher, the narrowest portion of these strictures, however, is usually just above the sphincter muscles at the insertion of the levator ani. Strictures involving the entire sigmoid and often the descending colon are obviously not amenable to diathermy.

Medical diathermy, if properly applied, has proved of considerable benefit in many cases of rectal stricture, particularly in the cases of lymphopathia venerea in colored females. It has unquestionably saved many of these patients the disagreeable ordeal of a colostomy, has materially lessened rectal discharge and secondary infectious processes, has alleviated pain and tenesmus and in general has made these unfortunates decidedly more comfortable.

Technic

Favorable results from the use of medical diathermy in strictures depend on careful technic and treatment must be continued indefinitely and at regular intervals. The technic is essentially as follows: The calibre and length of

* Read before the New York Physical Therapy Society, New York City, March 4, 1936.

the stricture should be determined by the surgeon or proctologist by the passage of Wales bougies before referring the case to the physical therapist. An x-ray of the colon should also be done. It may reveal multiple strictures. The active electrode is perhaps more easily inserted in the lateral Sims' position and the treatment may be given in this or the prone position. One or two large dispersive electrodes, to diminish skin resistance, may be used, one on the lower abdomen above the pubes and one over the lumbar spine which is a common site for referred reflexes from the rectum. They should fit snugly. Moulded electrodes are advantageous. The active electrode may be either a Hegar single or double curved metal bougie or a straight metal tube as devised by Frankfeldt with a convenient handle which is equipped with a binding post at its proximal end. When these are not available, small sized proctoscopes may be used or an electrode improvised by wrapping tin foil around the ordinary Wales rubber bougie.

It is important that the active electrode be encompassed by and extend the entire length of the stricture which pathologically constitutes an irregular fibrotic tube of varying diameters and thickness. It may be advisable in some cases to pass the ordinary rubber Wales bougie before passing the metal electrodes and it is perhaps advisable that the electrodes be passed under the supervision of the surgeon or proctologist, at least during the earlier treatments for it is sometimes necessary to introduce the electrodes under direct anoscopic control. In the female a vaginal examination gives additional information as to the extent and thickness of the stricture.

The degree of heat and the duration and the interval of treatments are very important. From personal observation and inquiry we believe that the thermal reaction in the stricture and surrounding tissue has not been sufficiently emphasized since it was first described by Picard. It should be noted that the softening of the stricture depends on the production of an exudative inflammatory reaction, and that bleeding and congestion of the surface of the stricture are symptoms of this reaction which is best obtained by continued high temperature. When it is apparent that the softening has taken place which usually occurs after the fourth or fifth treatment, rapid dilatation must be done by the introduction of increasingly larger bougies. Following eight or ten treatments the congestion, discharge of pus and mucus become less and dilatation is not so readily carried out. The earlier treatments should preferably be of 20 to 30 minutes' duration with 1500 to 2000 ma., if tolerated, two to three times weekly. If pain is complained of during treatments it usually denotes edema in the sphincter region and if severe, treatments should be postponed for a few days. It also denotes maximum heat.

It is noteworthy here that the sensation of heat is transmitted perhaps more by the sensitive anal cânal than by the strictured area itself, which area normally would be less sensitive for which reason it might be advisable to insulate the anal portion of the active electrode. Perhaps it is safer not to do so.

The difficulties of heat determination in the active electrodes are of course quite familiar and it would be rather presumptive for me to discuss the relation of the milliampere readings to the heat sensation of the patient or the size of the electrodes. We have incidently tried thermometers in the electrodes with no very definite advantage.

All this emphasizes the importance of frequent inspections of the the stricture by direct proctoscopy, which is too infrequently done. It further emphasizes the fact that the full benefits of diathermy can only be obtained by the constant cooperation of the proctologist and physical therapist. In selected cases in which there is considerable involvement of the anterior vaginal wall it may be of additional value to use abdomino-vaginal or sacro-vaginal diathermy.

In the interval between the diathermy séances rectal irrigations with permanganate solution 1:5000 to 1:8000 should be prescribed together with appropriate catharsis and diet. Medical diathermy should also play an important part in the preoperative treatment of rectal or anal strictures in which surgery, e.g. internal or external proctotomy, or where drainage incisions into the ischiorectal fossae are contemplated. It lessens the discharge and promotes future healing.

Conclusions

1. Medical diathermy is a valuable therapeutic agent in stricture of the rectum.
2. The cases should be selected, malignancy and multiple strictures carefully excluded.
3. Maximum heat of prolonged duration is important.
4. Closer cooperation between the protologist and physical therapist is earnestly recommended.

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Discussion

Dr. M. C. L. McGuinness (New York): Dr. Gorsch mentions the thermometer in the rectal electrode. This gives the temperature of the metal not of the tissues. The thermometer in the urethra or vagina during the treatment or in the rectum *after* the electrode has been removed is the only true measurement of tissue temperature. On an average it will be found that 106 degrees F. in the vagina or 104 degrees F. in the rectum is the optimum in rectal strictures. The long, steady, gentle heating of the tissues is most grateful to these patients who rebel at too high temperatures because of pain and discomfort.

Dr. William Lipchitz (New York): I have been using Dr. Frankfeldt's rectal electrodes at the Morrisania Hospital for several months. I find them very handy as much of heat may be given without discomfort to the patient. I have also used them for pelvic diathermy in gynecological conditions. The electrodes which I am using are slightly curved and not straight as the specimen exhibited here.

PHYSICAL THERAPY PROCEDURES IN OTOLOGY *

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In the treatment of sound conduction impairment many hesitate to ascribe any merit to massage or pneumo-massage or to interrupted sound wave massage as administered through the eustachian catheter. They regard it as having no influence either upon the tympanic circulation, the tympanic exudate or the fixedness of the ossicles. They credit it with no benefit either when used after recent inflammatory attacks or for hyperplasia of long standing.

Passive or physiologic manipulation has always been utilized by medical men in the treatment of many conditions surgical and non-surgical. In the general practice of medicine any articulation or other structure subject to inflammatory changes akin to those observed in the tympanum and its contained structures, would almost uniformly receive careful manipulation and massage as approved and helpful treatment. For exactly the same reason that passive motion would be administered elsewhere under like conditions, pneumo-massage and kindred measures have a place in our endeavor to preserve and improve the hearing in sound conduction impairment.

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 10, 1935.

Massage, in sound conduction impairment, is used after thorough diathermy and sinusoidal or negative galvanic treatments, and after tubal inflation when that measure is employed. Judiciously administered, massage induces hypervascularity and stimulates physiologic action of the non-functioning, encumbered structures. Patients comment favorably upon relief from this part of their treatment, convinced that the hearing is stimulated and the helpful results intensified and prolonged.

The hope is to restore function that has been interrupted or disturbed from repeated inflammatory attacks with accompanying exudates. Where exudate or transudate tends definitely toward tardy absorption or hyperplasia, physical therapy measures are of definite benefit. They are administered as measures accessory to the usual treatment everywhere employed.

Perforations of the Membrane

While not distinctly a physical therapy measure, the closure of perforations in the tympanic membrane is a procedure of definite value, both as a means of improving the hearing and of affording protection against middle ear infections.

No attempt should be made to close a perforation in a discharging ear. With the ear dry, no cholesteatoma or other serious middle ear impairment present and with less than half the membrane destroyed, closure is, under proper treatment, to be expected. I have never attempted closure where as much as two-thirds of the membrane had been destroyed.

For several years I have employed the following technic, with success in all cases except two; one of which, a nervous patient, was dismissed, the other discontinued the treatment. A few threads of cotton are wound about the point of a fine probe and dipped into trichloracetic acid. This saturated pledget is pressed against cotton, to remove all excess of the acid. The tip of the pledget is then carried into and made to contact around the entire margin of the cocainized drum perforation, producing a thin white marginal ring, half a mm. in width. A small, fluffy tuft of cotton, such as can be easily passed down against the drum head, is then dipped into protonuclein special powder, permitting it to pick up what will readily adhere. This dry, powder filled pledget is then exposed for five minutes to ultraviolet light from a water cooled lamp, after which it is placed neatly down against the drum head, contacting completely the margin of the perforation. The cotton is then dampened with several drops of euthymol, as suggested by Hazeltine, and kept constantly moist with three drops of the same solution applied three times a day. Dressings are changed every five or seven days. Stimulation by trichloracetic acid may be repeated after two weeks or when necessary.

The duration of a perforation, whether a few weeks or many years, neither increases nor decreases the care necessary to close it. The size of the perforation is of course a determining factor. My experience with the "Cargyle membrane" in effecting closure of perforations has been too limited to justify comments based on experience. It has served well in small perforations.

Zinc Ionization.—Zinc ionization in chronic, suppurative otitis media is very effective where indicated and where treatments are carefully given, but as the procedure and the indications have been extensively dealt with in the recent literature, indications and technic are omitted from this paper although the procedure is to be commended.

Ultraviolet Light.—In superficially situated furunculosis of the external meatus and in dermatitis of the meatal canal walls I have come to place a very definite value on ultraviolet light from a water cooled lamp through a quartz rod. Cases of fungoid development in the meatus, too, have yielded to ultraviolet light applications delivered in the same manner. From twenty to forty-

five second exposures have proved most effective. In suppurative otitis it has proved disappointing.

Sound Conduction Impairment

I am again stressing the helpful influence of electrically induced pyrexia together with other electrical, physical therapy measures in types of sound conduction impairment. Treatments to be of any considerable benefit in this condition must be administered only in those cases that have been definitely determined by tuning fork and other tests to be improvable. They should be administered early. Coates holds "that many, if not all cases of progressive deafness, that become manifest in adult life, have their inception in neglected middle ear inflammations in infancy and childhood."

Gundrum is even more emphatic in the statement that "the prognosis of all deafness in children depends upon early recognition and prompt treatment." I should like again to add my often repeated statement, that if physical therapy measures are to be helpful in this condition, they must be administered immediately to the impaired structure and the treatments must be thorough. It may be stated with equal frankness, that, as they are now generally employed, they are not effective and are usually reported as of questionable or even of no effect.

Only a very brief outline of the technic is repeated as it has been given on previous occasions. Diathermy and other electrical treatments to be effective should pass between the external meatus, filled with a current conducting solution, used as one contacting surface and a moist, cotton covered electrode applied about the mouth of the eustachian tube as the other contact surface. A measured temperature elevation from 105 to 108 degrees F. at both these contacts should be maintained for a period of twenty minutes. Negative galvanic and sinusoidal currents are employed through the same contacts, but detail as to the treatments are omitted here.

Regarding localized temperature elevations as a means of treatment Mendenhall states that "the main therapeutic effect aimed at, is the production of a pyrexia to a hyperpyrexia point, i.e. 104 degrees F. and above that figure." I have before quoted Crile, Kobak, and De Kraft in support of the same contention. Improvement results only from major temperature elevation.

I am presenting a report of but two cases, in which the watch and whisper tests only are recorded. Reports of series of cases may be found in other articles.

Case Reports

Case 1. — C. F. S. age 13, had from childhood occasional attacks of suppurating otitis in the left ear and increasing difficulty of hearing in both hears. Tests made February 4, 1927, showed: R.E.: W.V. 16 in. R.E.: W.V. 10 ft.
L.E.: W.V. 12 in. L.E.: W.V. 8 ft. Rinné negative — both ears. Weber to right. Right membrane slightly clouded, ossicles fairly movable. Left membrane revealed a 2 mm. perforation in lower posterior quadrant.

After closure of the perforation in the left membrane by procedures above described, thirty treatments were given both ears over a period of three months, at the end of which the patient was dismissed with both ears hearing watch at sixty inches and whispers at twenty feet.

The hearing has remained as when the treatments were discontinued, seven years ago. Both ears still hear watch at sixty inches and whispers at twenty feet; for low tones both ears are Renne —; at 1024 and above, both ears are Renne plus.

Case 2. — V. B. age 26, had experienced faulty hearing since a severe attack of influenza at the age of 18. An annoying tinnitus developed with failing in her hearing, with no improvement at any time, although treatments had been followed intermittently by her physician. A tonsil operation seven years before had afforded no relief.

Tests on October 20, 1928, showed R.E.: W.V. 10 in., L.E.: W.V. 12 in. Rinné negative— both ears, for all forks below 2048; tinnitus annoying but not constant; membranes slightly

clouded, ossicles movable, tubes somewhat restricted but patent. Diagnosis: Sound conduction impairment.

Treatments were at first given three times a week, then twice a week, then once a week and later once every month or after contracting a cold. There has been no tinnitus since the first months of treatment; the hearing slowly but steadily improved and at the end of twelve months was R.E.: W.V. 20 inches and L.E.: W.V. 28 in. At eighteen months, R.E.: W.V. 28 inches L.E. W.V. 38 inches. No regular treatments have been given the last four or five years, but tests now show R.E. 30 in. L.E. 40 in. Whispers each ear twenty feet and conversational hearing almost normal.

The histories of these two cases, typical of many, suggest that there is merit in physical therapy measures when thoroughly and faithfully employed.

714 Equitable Bldg.

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SOME PHYSICAL AND CLINICAL ASPECTS OF ULTRASHORT WAVES *

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NEW YORK

Some time ago we began experiments with ultrashort waves on small models of 5 watts or less output and after many disappointments finally succeeded in producing a variable machine of several hundred watts. In one report we stated its lower limit as 4 meters, whereas we were successful in bringing it down to 3.6 meters. In all two experimental variable short and ultrashort wave machines were built.

In spite of laboratory and clinical research by many authorities the status of ultrashort wave therapy is still in a state of flux. Our first object is to point out the very evident fact that there are many and varied commercial tube and spark gap machines, ranging greatly in meter wavelength and power output, all backed by reports of clinical evidence as to their efficacy. These reports place practitioners in a dilemma with reference to the significance of wavelength, ranging from three to thirty meters. On this basis either wavelength as such has little significance, or our present knowledge is inadequate.

Leaving for the present the question of wavelength there are a few correlations to be established between the power output from a machine and the method of its application. These two factors are interrelated and raise the question whether it is necessary to have a powerful machine of 300 or less wattage. Until recently, we believe the answer would have been to use if possible a more powerful apparatus, because of its need with spaced and directly applied rubber electrodes. With the cuff method, however, Bierman and Schwarzchild have shown by inserted thermocouples that the temperature of the interior of the leg close to the bone is many degrees higher than the surrounding skin or subcutaneous tissue.

Air Spaced Cuff Electrodes

The cuff method consists in placing two electrodes around the leg, spaced at variable distances from each other and the skin. The cuff method used on the limbs gives greater localized temperature rises in the depths than any other technic. For this a very powerful machine is not essential, as a 150 watt output produces a rise of 8.1 degrees F. in the deep muscle tissue, which still leaves open in certain quarters the question of the optimum level. We have taken a loaf of white bread and applied cuffs to each end. The space between the cuffs measured 3½ inches. The apparatus used was a tube machine, operating at 8 meters and about 200 watts. After three minutes we found the interior of the bread, two inches below the surface, and midway between the two cuffs to be 10 degrees C. higher in temperature than the surface immediately above it. Therefore, we think the cuff method applied to the limbs is the best means of producing heat in depth, but we do not as yet know what degree of heat will give the best clinical results.

With cuffs on the extremities we have encountered burns where the patients had complained of no undue heat sensations. We believe we have solved the problem experimentally by a new method of cuff application. The use of cuffs on the torso should be left for the present to animal experimentation.

Where the cuff method is not applicable we use condenser plates with

* Read at the Fourteenth Annual Session of the American Congress of Physical Therapy, Kansas City, Missouri, September 11, 1935.

an air gap between the plate and the part to be treated. Here we arrive at an entirely different situation. As the plates are smaller than the body between them, three main variables are to be considered:

1. The size of the plates.
2. The power output in watts.
3. The size of the air gap between the plates and the surface of the body.

These factors have been so thoroughly treated in the literature that we may restrict ourselves to a few points bearing upon clinical results. Two circular condenser plates, 5 inches in diameter, are placed in front and in back of the body, respectively, at the level of the navel and 1½ inches from the skin. We find that the patient can take an approximate output of 150 watts at 8 meters without feeling too great a heat sensation on the skin. Therefore, under such conditions it is unnecessary to have an apparatus with a greater output because the heating of the skin to the tolerance point is the factor limiting the power output in the patient's circuit. Since the 5-inch circular plates are relatively close to the skin, we get most of the lines of force entering the body between the surfaces of the two plates, and only a relatively few spreading out in increasing curves beyond the outer limits of the plates. Since heating depends entirely upon the number of force lines entering a unit area, it is very evident that by keeping the plates relatively close to the body, we are tending to concentrate our force lines in the area lying between the plates. Under these conditions let us assume an icrease of X degrees temperature, at a depth of Z inches. We are not going into the question of selective heat penetration or other complicating factors, as they are outside our discussion. To repeat, using, 5-inch plates, spaced 1½ inches from the body, at 8 meters and 150 watts output, we find in a unit time X degrees temperature rise at Z depth, which is a point on the central axis connecting the 2 plates. Spacing these plates 3½ inches from the body, we find in the unit time a much lower rise in temperature at Z depth than we had found with the plates closer to the body. This is so because with the plates at a greater distance, the curving lines of force take in a much larger area, hence the concentration of force lines is less. Therefore, the unit heating at Z depth is less. The body is receiving the same amount of energy as previously, only over a larger area.

With the plates at 3½ inches and an increase to say 350 watts, we obtain in the same unit time, an increase of X degrees temperature at Z depth, exactly the same result that we obtained with the plates 1½ inches from the body and a 150 watt output at 8 meters. Since the plates are 3½ inches away from the skin the patient feels little skin warmth. Again we find the curving lines of force taking in an area larger than the size of the plates. Because of the increased power of the apparatus the patient is absorbing more energy over a larger area of the body, while the temperature rise along the axial plane of the electrodes remains the same as with the 150 watt machine with 1½ inch electrode spacing. It is this extra energy spread over a larger area with which we are especially concerned, because using an apparatus of the approximate power stated above and under the same conditions we have obtained systemic rises in temperature of 2 degrees F. and higher. In this way we have produced a local plus a systemic heat reaction. It is very obvious that this systemic reaction depends upon a powerful apparatus at 8 meters, plus a relatively large spacing of the electrodes from the body. In our opinion this systemic rise in temperature is an important factor in the production of favorable results. It is important to bear in mind that this is not fever therapy, which can best be accomplished with a 30-meter wave: *It is primarily a local with a secondary systemic effect.*

Air Spaced Electrode for Head Treatment

When treating the head the cuff method is inapplicable. Condenser plates with an air gap must be used. In our opinion the best method of application consists in placing the electrodes parallel to and equidistant from each cheek. The anteroposterior position we have abandoned for two reasons:

1. There is slight danger of causing some deleterious effect on the brain.
2. The nose approaches much more closely to the front plate than any other part of the face. Since there is a concentration of force lines entering the nose at its tip we find a point of maximum heating there, and the patient soon complains of a burning sensation in the nose. It is possible by drawing lines of force away from the nose with insulated metal balls strategically inserted in the field to eliminate the excessive heating of the nose. This has not been worked out clinically.

Because of the above two considerations the latter position is the better of the two. If the electrodes are spaced 1 inch from the sides of the cheeks we find that the ears tend to overheat, since they are closer to the electrodes than the cheeks. For this reason ears should be taped as close to the head as possible. The same question of spacing the electrodes arises here as when treating the torso. We use 6-inch plates, spaced approximately 3 inches from each side of the head, with an output at 8 meters of about 300 watts. Since the plates are three inches from each cheek the patient has little sensation of skin warmth, the uneven aspects of the cheeks and ears tend to minimize local concentrations of heat at those points of irregularity, and the patient can turn his head to assume a more comfortable position without fear of undue local heating.

Finally we wish to touch upon those forces which act on the patient. Primarily we are concerned with a high frequency field lying between two condenser plates. Through this field travel electrostatic lines of force of definite oscillatory frequency. It is the effect of these force lines on the body that concerns us. Therefore the questions arise: How these force lines are distributed in the high frequency field; whether they travel in parallel lines; how they vary in curvature and density, and the like. While this problem is purely one of physics, it is basic for the use of short waves in medicine. We have attempted a practical solution of the problem by actually tracing out the force lines in the high frequency field.

Demonstration of Force Lines at 8 Meters

To perform the experiments, the above-described 300 watt, 8 meter short wave therapy machine was equipped with a pair of circular plates 5.88 inches in diameter and adjustably mounted. Measurements were taken by a special neon bulb ½ inch long by ⅛ inch inside diameter, with thin Pyrex walls and with an 18-inch tubular Pyrex handle 3/17 of an inch in outside diameter. The handle was attached at one end of the bulb, to form with it a right angle. When this instrument was held in a strong field, the bulb luminesced; however, but if not rotated in various ways, it did not light up for all positions, but only when the ½-inch dimension of the bulb pointed approximately in the direction of the lines of force of the electric field. Furthermore when the field intensity was gradually weakened by adjusting the plate current, the bulb had to be oriented more and more accurately before ignition would occur. With the field intensity adjusted so that the bulb ignites when pointing in only one direction, it may be assumed that the direction in which the bulb has its maximum dimension is the average direction of the lines of force within the bulb. We are making

these experiments also in body cavities but are not sufficiently advanced for a definite report.

When measurements are taken with this instrument, it is important that the point of reading is accurately recorded so that a chart of all points may be constructed. To this end a rectangular frame 27x28½ inches was doweled together without using any metal. The frame was large enough so that it could be located in a vertical plane perpendicular to the two electrodes, and passing through the line connecting the centers of the two electrodes without coming too close to the plates anywhere. The entire frame was fitted with parallel vertical threads of fine cotton, all spaced 1 inch apart. These threads were fitted into place and then marked with ink every inch along their length, so that the final result was to have X visible spots of ink all over the plane of the frame, marking off the inches in all directions, and the whole resembling a sheet of cross-section paper. With the aid of this portable frame and with the electrodes fixed between the threads, it becomes possible to chart all of the points of equal field strength and at the same time the directions of the lines of force. As soon as all of the points have been taken with a given field strength, the field strength is changed by an adjustment in the generating machine, and a fresh set of readings are taken. Since the direction of the field is not dependent on its strength, all points obtained may be plotted on the same paper, and a complete picture of the directions of the lines of force obtained. After the directions have been plotted, the surfaces of equal potential may be deduced from them, since these are everywhere at right angles to the direction of the field. It is important that there be no confusion between the surfaces of equal field intensity, and the surface of equal potential. The surface connecting the points at which the bulb will just ignite are surfaces of equal field intensity, and do not resemble equipotential surfaces.

Clinical Aspects

The pendulum of clinical results swings from extreme to extreme. The remarkable results found in many reports are too fantastic to be believed. That these patients became well is not denied, but that the ultrashort waves were the sole means of cure must be doubted. The other extreme of the pendulum is shown in a report of a reputable surgeon who one year ago purchased a 6 meter tube machine of 225 to 300 watts output in the patient circuit. He claims to have used a modality recommended by the manufacturer, and states after one year's experience that in his opinion its results have been disappointly poor. His series totals 95 cases. These are two extreme examples. Somewhat in the middle is a niche for short wave therapy, but controlled work must be the basis on which it should rest.

Our experiences have been many and varied. That psychic factors have played some part can not be denied. We present a few observations:

A. E., salesman. While being treated for a sinus condition he stated that for the past year whenever he lifted his arm he felt a peculiar shooting pain in the shoulder. X-ray examination was negative. The shoulder was put between the condenser plates, the power turned on, but the apparatus was put out of resonance. There was no high frequency field existing between the plates. After 5 minutes treatment the patient felt much better, and he could lift the right arm without pain. On his return one week later, he stated that the pain had returned several days after the treatment. He was given another 5 minute exposure to a de-resonated apparatus and again had relief from pain. Two weeks later he was still free from pain. I have ten such psychic results in varying conditions.

Because of the limitations of time, we will confine our discussion of clinical results to acute and chronic sinus conditions. Our method of treatment consists in using either 6 inch circular, or 7 inch square plates. These are placed parallel to and equidistant from the cheeks at a distance of ap-

proximately 3 inches. Our output is above 300 watts. We know that other methods of treatment utilize much smaller plates, placed approximately 1 inch from the cheeks, and powered by an output of approximately 150 watts. Which method is best is open to discussion. We prefer ours because of the secondary constitutional fever reaction which we believe plays an important part in overcoming infection. Ultrashort wave therapy relieves the accompanying pain of both acute and chronic sinus conditions. We believe that short waves are not a specific cure for sinus infection, but act as a powerful adjuvant. Our series of cases run well above a hundred, and typical of these are:

C. E. Patient had a severe cold about 8 weeks ago which persisted, with marked clogging of the nose, and much purulent discharge especially from the right side. She was treated with nose drops, nasal irrigation, and heat for several weeks without result Six weeks after the onset of the cold, she suddenly developed severe pain in the right side of the face which persisted in spite of therapy. X-rays taken at that time showed an empyema of the right antrum. We saw her 2 weeks after the onset of the pain. The pus was removed from the nose without the use of suction, and ephedrine packs placed against the antrum orifices to facilitate drainage. With an 8-meter wave as described above, the patient was given a 30-minute treatment. At its termination the pain had disappeared. The patient returned daily, for both nasal and short wave therapy. The severe pain never returned, and the patient was cured at the end of a week.

Our results with acute sinus conditions have in the great majority of cases been successful. But we emphasize that it is not sufficient to place a patient between two condenser plates and utilize ultrashort wave therapy as a cure-all. That patient must also have intelligent nasal treatment.

In the treatment of chronic sinus conditions even more depends upon the recognition of the type of infection and its extent. It is the height of optimism in cases of purulent nasal discharge to give short wave treatments and expect a cure. Short waves can do much in sinus infections, but must be used as an adjuvant and not as a specific. We believe that in general the medical profession will get poor results treating chronic sinus conditions with ultrashort waves, not because of the modality but of lack of skill in the operator.

In chronic sinus conditions with ultrashort waves as an adjuvant to accepted therapy our results were definitely better than in a series treated without ultrashort waves. In many cases the results were surprisingly good, especially where pain was a disturbing factor.

Summary

1. The question of an optimum wavelength is still mooted.

2. The cuff method gives the greatest internal heating when used on the limbs but is inapplicable as yet to the torso.

3. For the head and the torso large condenser electrodes, advantageously spaced from the body, will produce not only a local but also a constitutional effect.

4. Experiments have facilitated the actual tracing of force lines in a high frequency field.

5. Short and ultrashort waves constitute a powerful therapeutic modality in suitable conditions.

144 West 86th Street.

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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EDITORIALS

THE PROBLEM OF HEAT PENETRATION BY SHORT WAVES

Although d'Arsonval had clearly demonstrated the physiologic properties of the high frequency current, properties that suggested a new field in electrotherapy, a number of years elapsed before the medical profession overcame the barrier of habituated skepticism and began to utilize available information about the therapeutic value of what is today designated as conventional diathermy. A similar situation has existed ever since the attention of the profession has been drawn to the superior therapeutic properties to be obtained from the use of short wave diathermy. While this latest addition to our therapeutic armamentarium had the advantage of being born at a time when high frequency therapy had already acquired citizenship, it, too, is destined to pass through a period of skepticism or even negation owing in part to the circumstance that many conservative investigators have undertaken both clinical and experimental labors without thorough familiarity with all available facts.

The situation that today confronts the critical student is not without its duplication in the history of medicine and of the allied sciences. One need only recall the obstacles placed in the paths of such discoveries as the circulation of the blood by Harvey, the law of absorption by v. Grotthus, Lister's antisepsis, the agency of bacteria in fermentation and decomposition by Pasteur, and others, to realize that the same psychologic factors underlie present day failure to accept tangible advances in various domains of science. An affirmation is a challenge to a negation, a creative idea provokes a train of reactions running the gamut from credulity to skepticism and even cynicism, so that to many reality appears as fancy, and experience as the distorted figment of an overworked imagination. It is precisely under such circumstances that inability to duplicate concrete experiments of others has given rise to the fallacy that negative results disprove positive ones as

a criterion for scientific recognition. It is quite evident that when two investigators arrive at unlike conclusions, they could not possibly have performed the same experiment in an identical manner. Both results are undoubtedly correct, but the objective to be sought is the determination at what point of departure differences arose. This is particularly apropos in relation to recent contributions on short wave electric oscillations, a field of biologic radiations little understood because our knowledge is still in the formative period and our experience in that plastic stage which thrives best under a regime of tolerance and delayed judgment.

Reverting to d'Arsonval's epochal discoveries in high frequency current, it has taken about four decades before organized medicine became sufficiently oriented in its biologic and therapeutic action to accord it recognition and official sanction. As Bergonié has aptly stated, it arrived too soon for a profession too uninformed of its biophysical and physiologic characteristics to regard it with any greater enthusiasm than friendly suspicion. The situation with reference to short wave electric radiation is more favorable since the profession is already sufficiently familiar with the fundamentals of thermodynamics as related to the high frequency current to appreciate that the basic factor involved in its action is the introduction of certain quanta of energy (variable with wavelength) that become converted into thermal and chemical phenomena, which in turn provoke physiologic and therapeutic responses. Irrespective whether it is propinquity to or lack of familiarity with this energy which impels us to look upon heat as an ordinary event in our daily experience, its action nevertheless is so far reaching that its influence extends to cosmic, subelectronic and intermediary spheres. Heat undoubtedly is the most potent of nature's remedies — universal, convertible and indestructible. Hence the concern of recent investigators is not whether the primary action of short wave fields is thermal in character but whether or not it possesses other manifestations that would render it a more dependable and flexible agency for clinical purposes.

At the present moment the profession in America is confronted with a situation of general agreement about the superiority of short wave over conventional diathermy, but of disagreement as regards a selective and deeper heating nature of the ultrashort range as compared with the longer wavelengths. Certain investigators have insisted that research in this field be conducted on living human material in contrast to foreign workers who have conducted their labors along the lines of accepted classic methods in other fields. The latter early realized that certain valuable implications could be obtained *in vitro* experiments with short wave selective fields, though such are most often impossible of attainment in pharmacologic experiments. As a matter of fact the *in vitro* experiments yielded indices which cleared the path for similar experiments of a more complicated nature on living material, revealing a distinct relation between the two. All this led to the development of a proper technic, a differentiation of values between induced and capacitive currents as compared with rubber pad condensers and air-spaced electrodes. It also enabled the pioneers, notably Schliephake, Kowarschik, and others to demonstrate selective heating of living (human) and biologic (animal) material either by a special technic or by the actual effects of the greater quanta of energy inherent in the ultrashort range. It was but a step, and a brilliant one, to make use of this information for therapeutic purposes. Clinical evidence of the therapeutic value of the ultrashort waves under proper dosage and technic is today mounting to such a volume as to assure for this type of therapy a permanence in spite of a rather skeptical attitude on the part of a number of serious minded investigators. If anything, there is even danger of an overenthusiasm that may lead to improper

exploitation of a procedure that in proper hands will enhance our therapeutic results. As always one relies on the Council on Physical Therapy of the American Medical Association to exercise a balancing influence to safeguard scientific physical medicine.

The most recent contributors on this subject published elsewhere in this issue[1-2] are arriving at conclusions virtually identical with those of the above mentioned pioneers, so far as thermopenetration is concerned. Although opposed to Schliephake's interpretation of the heating action of short wave radiation, Coulter, not unlike the former, explains it as a purely thermal action, but in spite of his exaction for tests on living human material supports his contention on experiments performed by others on fruit flies, tadpoles, the extirpated pulsating heart of an animal, on hypotheses advanced by Holzer, on a speculation of Kovács' and the like. On the other hand his application of the 6 and 9 meter wavelengths through proper air-spaced electrodes to humans leads to evidence of virtual agreement with the interpretations by Schliephake that shorter wavelengths tend to produce greater heating in the muscular than in the subcutaneous region, contrasting with Coulter's experimental findings with longer wavelengths.

Our other contributor, Egan, reports on the treatment of over 1,000 patients with ultrashort wave fields. In the last analysis this is the proper tangible evidence of the effectiveness of any therapeutic method and no room is left for doubt that Egan has demonstrated in the clinic what is still a subject of debate in the laboratory. The comprehensiveness of his material and the precise interpretation of his results add to the statistical evidence submitted in the past by Schliephake. Here again is confirmation of the truism: First come facts — and then theories.

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PHYSICAL THERAPY IN HOSPITALS

It is gratifying to know that a note of warning has been sounded for hospitals to facilitate properly administered physical therapy or lose the coveted approval by such authoritative bodies as the American Medical Association and the American College of Surgeons. Recently the latter has published an official statement,[1] which hospitals in the United States will do well to heed. In this statement the authorities of the American College of Surgeons have called attention to the fact "the steadily increasing knowledge of physical therapy and its application to medical practice has in recent years brought about a widespread use of this adjunct type of treatment." The inference is that physical therapy has proved so valuable in the management of a vast number of diseases that hospitals are in duty bound to enable their staffs to avail themselves of it in indicated cases. In its official statement this important surgical organization further points out that two factors have tended to develop the usefulness and efficiency of a properly organized and supervised department of physical therapy in hospitals, namely, the perfection of equipment and the training and registration of technicians. Again and again it is stressed that no department of physical therapy can be regarded as acceptable unless it is supervised by a properly qualified physi-

cian. In fact, the college authorities go so far as to stress that where such a condition is not complied with, hospitals had better not undertake the equipment of a physical therapy department.

The meaning of all this is clear. Ever since the American Congress of Physical Therapy has come into being, it has preached in season and out of season precisely what the representative surgical body now promulgates as an essential to efficient hospital care. The Congress has frequently stressed the need for absolute control of physical therapy departments by qualified physicians. What is meant by qualified physical therapists should require no great legal acumen to decide. The most prominent members of our Congress are the last persons on earth who wish to be known as physical therapists pure and simple. They are first, last and all the time physicians who have devoted special study to the nature and therapeutic effect of physical agents and who realize that general therapy is too large a domain in medical science to be restricted to one or the other type of treatment. Thus the physician paying special attention to physical therapy knows the value and makes extensive use of medicaments, sera, vaccines, orthopedics, and even surgery with the cooperation of especially qualified colleagues whenever need be.

And just as, to cite an example, no orthopedic surgeon will entrust patients to a nurse for manipulative treatment without first making sure that the aide or helper will carry out his instructions to the very letter, so no physician or hospital authority should venture to refer a patient to the physical therapy department without being sure that first of all the desired therapeutic measure is properly indicated and, second, that it will be properly administered. For this there is need of a highly trained colleague. That this man cannot possibly be expected to devote hour after hour to time-consuming applications needs no proof, and it is to relieve him of mechanical details not involving great manual skill that there have been created special training schools of physical therapy technicians. Such a technician may be ever so well trained, but she or he cannot be expected to determine such intricate questions as indications, contraindications, dosage, and even the proper manner of utilizing established modalities in medicine. A hospital may expend large sums and have set aside much space for a veritable machinery hall and still possess no physical therapy department. As a matter of fact the better trained the physical therapist is, the less and the simpler apparatus he makes use of, for in the last analysis it is not the machine that cures but the brain that directs its intelligent utilization.

In the light of what has been said it is clear that hospitals who merely invest money for the possession of electrical apparatus, equipment for heliotherapy or even install complicated plumbing for the various types of hydrotherapy will fail to obtain recognition as hospitals on the approved list by any or all of our great national bodies unless they have on their staffs at least one graduate who by special study and preparation is thoroughly familiar with the technics, which in turn also implies familiarity with the biologic effects of each and every modality.

A hospital, to illustrate by a comparison, may have ever so costly an equipment of sterilizers, anesthesia outfits and cases filled with the finest operating instruments and will still have no surgical department unless it has surgeons with the requisite knowledge and skill to make use of the equipment in accordance with the latest advances in the science and art of surgery.

Identically a similar situation holds good for the physical therapy or for that matter with the x-ray, pathologic, bacteriologic, chemical or other department that can be made use of only by specialistically trained physicians. And just as routine only, mechanical labors are carried on in the last

named departments by technicians, so in the physical therapy department there must be professional supervision by a man capable of intelligently cooperating with all members of the staff and insuring them the greatest possible benefits to be derived from proper physical therapy.

There is no reason to have the least doubt that in the near future other national medical organizations, such for example as the American College of Physicians or the American Hospital Association will lend their moral and material support to the conditions laid down by the American College of Surgeons in the interest of adequate care of the sick and injured patients in hospitals.

Reference

1. Bulletin of the American College of Surgeons **21**:4 (October) 1936.

PITFALLS IN PHYSICAL MEDICINE

In a recent address in London, Lord Horder discussed the pitfalls in physical therapy. He pointed out that physical medicine was one of the oldest of therapeutic efforts. It was only during recent years that the various methods of physical medicine had been brought under that scientific control which was essential to the proper exploitation of any method designed for the patient's interest. Such a wealth of methods and apparatus was available in this field that one almost hoped no more would be forthcoming for a time, in order to allow of a breathing space to try out the methods already at hand.

The achievements of physical medicine had been considerable, its potentialities were incalculable, but of course, there were pitfalls. The method must not be applied indiscriminately to all sorts of disease. With the public's childlike love for machinery the temptation so to apply it was very great. There was also a danger lest physiotherapists should not keep closely enough in touch with the physicist on one side and the clinician on the other. To a considerable extent the physiotherapist at his or her best must be both physicist and clinician. But the physiotherapist must look for support, if not for guidance, to the pure physicist and to the pure clinician, taking his problems first to the one and then to the other for discussion and criticism. Just as the physiotherapist had much to teach the rest of medicine, so he had much to learn from it, and he must constantly remember that there is no end to learning. There was also a danger lest he wander away from the bedrock of pathology and lose himself in a sea of speculation, or construct his own pathology, a more fatal error, because a specially constructed pathology within a group of medicine could only be at long last a pseudopathology. Lastly there was the peculiar danger that his efforts might be cramped by an attempt at commercialism on the part of astute business men.

These pitfalls could be avoided by several safeguards: First, the mental integrity of the practitioner himself, also his colleagueship and all that that implied, the group spirit, which was an essential factor in securing advance along the best lines, and the provision of opportunities for free discussion and criticism and dissemination of knowledge and technic. If it were said that such safeguards were all of them things of the spirit rather than material things, then, without being sententious, he would remind them that real safeguards were always and only of that kind. — [Address by Lord Horder, Brit. M. J. **3928**:808 (Apr. 18) 1936.]

SCIENCE, NEWS, COMMENTS

Pacific Physical Therapy Association Meeting

The regular October meeting of the Pacific Physical Therapy Association was held October 28 at the Hollywood Hospital at which time a program was presented as follows:

1. "Report on the 15th Annual Session, American Congress of Physical Therapy," by John Severy Hibben, M.D., Pasadena.
2. "Physical Therapy in Skin Affections," by Samuel H. Pettler, M.D., Los Angeles.

The Nobel Prize in Medicine and Physiology

The Nobel prize was founded in 1895, by Alfred Nobel, for the purpose of rewarding the five persons who had contributed the most notable work during the year preceding in medicine and physiology, in physics, in chemistry, in literature, and for the most brilliant and weighty contribution for the peace of the world. The award in medicine and physiology comes through the adjudication of the faculty of the Caroline Institute of Stockholm and consists of a medal, a diploma and about $40,000 in cash. The 1936 Nobel prize is shared by two individuals separated by nationality and language, but united in inspiration, though independent of each other, in the line of research that occupied the major portion of their lives. The award introduces two new luminaries to this distinguished list and calls attention to their discoveries related to the chemical transmission of nervous activity. They are Sir Henry Hallet Dale, of London, director of the National Institute of Medicinal Research in Hampstead, and Dr. Otto Loewi, of Austria, Professor of Pharmacology at the University of Gratz. According to *Science News Letter*:

"Prof. Loewi's work is declared fundamental and original. Much of it would have been impossible without Sir Henry Dale's work on the chemical called acetylcholine, which Sir Henry found to act as messenger between nerves and muscles. Prof. Loewi's research in turn stimulated Sir Henry's later researches on this chemical.

"There is thus an intimate connection between the work of these two investigators which justified a joint award. While their work is closely related, the two scientists have not collaborated directly.

"The chemical and physiological phenomenon, the discovery of which won this high honor, occurs hundreds of times a second in the body of an active person. Every time a thought commands certain nerves in the body to move a muscle, there is an almost infinitesimal spurt of a chemical, called acetylcholine. This release of chemical acts as a chemical messenger, giving orders to the muscle from the nerve.

"It is hard to imagine the small amount of this chemical that is needed to act as a chemical postman. And it is difficult to visualize the effect of the speed and complexity of the happening.

"Sir Henry Dale on his most recent visit to America in 1934 estimated that each outpouring spurt of acetylcholine consists of three million molecules, a very small quantity. To express this weight in grams, the scientific unit of weight that is one-thirtieth of an ounce, it is necessary to write fourteen naughts to the right of a decimal point before a figure is reached.

"Acetylcholine is thus recognized as one of the most important substances in the living body. Its potential usefulness in medicine is foreseen.

"Sir Henry Dale is well known in America and he has lectured before universities and scientific societies here. He is considered one of the leaders in British science. He is now 61.

"Dr. Otto Loewi is a man in middle life and he is recognized in America as well as Europe for his researches on nervous function, particularly on the transmission of impulses in the vagus nerve, a cranial nerve exercising important control over heart, lungs, stomach and other vital organs. He has been in the United States several times, most recently in 1930."

Applied Physics Council New Link With Industry

A mobilization of physicists to aid industry is under way. Following the conference on industrial physics held at the University of Pittsburgh, a National Advisory Council on Applied Physics has been formed.

Radio, aviation, refrigeration and others new industries resulted from the application of physics. The research workers in physics are eager to bring home to business and banking leaders the possibilities of translating the products of the laboratory and physical theory into new products and machines for our civilization.

Forty leaders in physics form the new council, and they will point out the way physics can aid railroads, housing, air conditioning, food preservation, glass, rubber, paint and other manufacture, photography, television and many other fields.

Included among the membership of the newly formed council are:

Dr. Karl T. Compton, president of Massachusetts Institute of Technology and chairman of President Roosevelt's Science Advisory Board; Carl L. Bausch, Bausch and Lomb Optical Company; Dr. Lyman J. Briggs, director, U. S. Bureau of Standards. Dr. Paul D. Foote, executive vice-president, Gulf Research and Development Corporation; Dr. Lloyd A. Jones, physics department, Research Laboratory, Eastman Kodak Company; Dr. C. F. Kettering, general director of Research and vice-president, General Motors Corporation; Dr. George B. Pegram, professor of physics, Columbia University;

Dr. F. K. Richtmyer, dean of the graduate school, Cornell University; and Dr. Henry A. Barton, director of the American Institute of Physics. — *Science News Letter.*

Helium Treatment for Asthma Made Cheaper

Reduction in the cost of helium treatments for asthma is now possible through improvement in method, Dr. Alvan L. Barach of Columbia University School of Medicine has announced.

Dr. Barach is the originator of the method by which patients suffering from severe asthma are given relief by inhalation of a mixture of oxygen and helium. Because helium is a very light weight gas, it requires only half the effort to breathe the oxygen-helium mixture as to breathe ordinary air, Dr. Barach found. This gives the patient's breathing muscles considerable relief and rest. While not a cure for asthma, the helium treatment has been found an effective remedy in combination with adrenalin.

Helium, however, is an expensive gas, so only a few patients could get the benefit of the treatment. Dr. Barach announced a method of re-using the helium, thus reducing expense. After the gas has left the patient's lungs it is circulated through soda-lime and returned to the apparatus to be used again. — *Science News Letter.*

Brighter Outlook for Heart Disease Patients

A brighter outlook for patients suffering from heart disease of the type known as coronary thrombosis appears in the report of Dr. Louis Faugeres Bishop, Jr., New York City, at the meeting of the Southern Medical Association.

It is no longer necessary for the patient to live in deadly fear when his ailment has been diagnosed as coronary thrombosis or occlusion, Dr. Bishop indicated.

"Now it is well known that the chances of an individual surviving the first attack are extremely good, 80 to 85 per cent," Dr. Bishop said. "Life expectancy following coronary thrombosis may extend as long as seventeen years."

The particular type of heart disease Dr. Bishop discussed is that in which one or more blood vessels of the heart itself are closed so that the blood cannot get through to nourish the heart muscle.

Improved methods of diagnosis and treatment are the factor credited by Dr. Bishop for the improvement in outlook for these patients. The electrocardiagraph and determination of the sedimentation rate help doctors to detect the atypical and milder cases and start treatment early. Physicians have also learned to be on the lookout for heart ailments when a patient complains of abdominal distress, since it is now known that the symptoms of this form of heart disease and of abdominal disease may be very similar.

Prolonged absolute rest, oxygen, and a diet low in calories are now recognized as important parts of the treatment and are helping to prolong the lives of many heart disease patients, he pointed out. — *Science News Letter.*

Congenital Syphilis Can Be Prevented, Specialists Find

Congenital syphilis is practically a preventable disease.

So announced Dr. Harold N. Cole of Cleveland and seven other medical specialists who, under the name of the Cooperative Clinical Group, have studied the pooled records of five large syphilis clinics in the United States to determine the outcome of pregnancy in women treated for syphilis.

The prevention of congenital syphilis is dependent upon the routine, early and repeated use of the serologic blood test on every expectant mother and on adequate early treatment once the diagnosis of syphilis is made.

The study reported has been conducted through the cooperation of syphilis clinics of Western Reserve University, the Johns Hopkins University, Mayo Clinic, University of Pennsylvania and University of Michigan, assisted by the U. S. Public Health Service and supported by a special fund contributed by an anonymous donor and a grant by the Milbank Memorial fund. Those signing the report with Dr. Cole of Cleveland are Lida J. Usilton, Washington, D. C.; Dr. Joseph Earle Moore, Baltimore; Dr. Paul A. O'Leary, Rochester, Minn.; Dr. John H. Stokes, Philadelphia; Dr. Udo J. Wile, Ann Arbor, Mich.; Dr. Thomas Parran, Jr., Albany, N. Y., and Dr. R. A. Vonderlehr, Washington, D. C.

Among their findings were the following:

1. A positive blood test for syphilis in the mother is a serious matter to the unborn child. Ten times as many syphilitic children were born when the syphilitic mother's blood was positive during pregnancy as when it was negative.

2. The pregnant syphilitic woman was found to tolerate anti-syphilitic treatment as well or better than the syphilitic woman who had not been pregnant since infection.

3. There is evidence that syphilitic women who habitually abort are capable of producing living, apparently non-syphilitic children when given specific treatment through each pregnancy.

4. Many non-syphilitic living children were born when anti-syphilitic treatment was begun before the fifth month of pregnancy than when treatment was delayed.

5. If an early syphilis appears late in pregnancy, some treatment begun at this period and continued until termination of the pregnancy, even though it is only a small amount, will be of value in the production of a living child.

6. Treatment during a preceding pregnancy is insufficient protection for the present pregnancy, even though the syphilitic woman has a negative blood reaction. It is necessary to treat her throughout each pregnancy in order to insure a living non-syphilitic infant. — *Science News Letter.*

Obituary

The Congress learns with regret of the passing of Dr. Emma Connor, on February 16, 1936, to her eternal rest. Dr. Connor is mourned by a host of friends, patients and colleagues. The Congress expresses sympathy to Dr. Connor's family.

THE STUDENT'S LIBRARY

TUMORS OF THE URINARY BLADDER. By *Edwin Beer*, M.D., F.A.C.S., Visiting Surgeon, Mount Sinai Hospital; Consulting Surgeon, Bellevue Hospital, New York City. Cloth. Pp. 166, with 52 illustrations including 8 in color. Price, $3.50. Baltimore: William Wood & Company, 1935.

The urologic specialty is today regarded with respect and approbation because its modern pioneers had the courage and foresight to integrate their study with the highest concept of surgery, and the newer advances in science. The preceding several decades have thus provided an inspirational background responsible for advances in this field. Of the notable contributions during this renaissance period the work of Beer must be counted as among the leading in urologic surgery. While it is true that Hippocrates in his aphorisms makes mention of tumors of the bladder, it was only during the past fifty years that rational surgical intervention came into recognition, and with it the natural evolution of operative procedures. The birth and development of the cystoscope and the application of the high frequency current and of radium implants, contributed the means for the excision and destruction of neoplastic conditions by the transurethral route. The progress from the manual to the electric scalpel is perhaps one of the most fascinating chapters of urologic history. Beer's monograph presents the salient facts regarding the past and present concepts of tumors of the bladder, their behavior from both the clinico-pathologic and therapeutic aspect, and the author's personal experience of twenty-five years of study.

In the space of twelve chapters, which includes an extensive bibliography and a well organized index, the author provides a scholarly background and a comprehensive exposition of the trends and progress in this special branch of surgical practice. It sketches the historic conception and present orientation of this particular problem, devoting special chapters to discussions of causative factors and biologic characteristics, pathology, symptoms, diagnosis and treatment of tumors of the bladder. Considerable space and detailed analysis has been expended to what is perhaps the most important feature of this problem — its therapy. Nearly two-thirds of the text deals with considerations of treatment and brings into focus the various procedures once in vogue or now emphasized in the light of recent developments in radiation therapy and high frequency technics. Beer has attempted to present in broad strokes as well as in detail a comprehensive and critical exposition of the many developments that have provided a newer orientation on tumors of the bladder. It represents by no means an optimistic picture but rather a conservative evaluation of past efforts and present contributions toward the more intelligent management of this difficult problem. He states: "It would be rankest folly to think that we have reached the ultimate, definitive methods of treatment in this serious condition, and it is more than likely that further work will lead to further development" along similar new lines in order to obviate the dangerous and mutilative operations of which this organ is not an exception. Here is a work that is timely, authoritative and scholarly, written by a pioneer whose style is clear and brief — virtues that make for lasting contributions.

UROLOGICAL ROENTGENOGRAPHY. A Manual for Students and Practitioners. By *Miley B. Wesson*, M.D., Ex-president, American Urologic Society, and Howard E. Ruggles, M.D., Roentgenologist to University of California Hospital and St. Luke's Hospital, and Clinical Professor of Roentgenology, University of California Medical School. Cloth. Pp. 269 with 227 illustrations. Price, $5.00. Philadelphia: Lea & Febiger, 1936.

The increasing demands by the general practitioner, the roentgenologist and the urologist for a clear and compact manual on urologic roentgenography have been met by the publication of this work as an aid to the better interpretation of urograms. It is interesting to note that the preparation of this work required some thirteen years of effort and arose from the suggestion by Howard E. Kelly of Baltimore, that such a contribution would fill a demand over a wide medical field. The work has been made possible by the cooperation of the American Urologic Association, which contributed roentgenograms, together with case histories, calculated to demonstrate the most salient diagnostic features. Moreover, in order to make findings of greatest value, the roentgenograms have been confirmed by clinical, operative or autopsy studies. The work is therefore rich in verified material, authoritative exposition, and in illustrative examples. It is comprehensive in the wide field it surveys and at the same time provides a compactness found only in properly prepared case histories. The legends of the 227 illustrations are complete and terse in themselves so that their very brevity suggests a parallelism to case reports proper and hence make for a clearer interpretation of the most characteristic changes noted in the published films. The arrangement of the text covering thirteen chapters, to each of which is appended an extensive bibliography, presents not only an historic background but also discussions of technic for urographic efforts, the normal and pathologic anatomy of the urologic tract and the possible lesions mentioned therein. From what has been said it is evident that the work represents an authoritative exposition and interpretation of urograms for progressive general and special practitioners.

TREATMENT OF FRACTURES IN GENERAL PRACTICE. By *W. H. Ogilvie*, M.D., M.Ch., F.R.C.S. Two Volumes, Second Edition. Cloth. Price, 2s. 6d. Pp. 180 with 37 illustrations. London, John Bale, Sons & Danielson, Ltd., 1936.

These two volumes are part of a series of pocket monographs on practical medicine, presenting a useful outline of fracture treatment for the general practitioner. Part one contains an excellent description of the general principles of fracture treatment, the remainder of the first volume being devoted to the treatment of fractures of the upper limb and limb-girdle. Volume two describes the treatment of fractures of the lower limb, the spine and the thorax. The illustrations elucidate many points in the text, and in particular show the use of simple substitutes for apparatus that are costly or difficult to obtain. These two pocket-size books offer an excellent outline of fracture treatment for the general practitioner.

NEW PATHWAYS FOR CHILDREN WITH CEREBRAL PALSY. By *Gladys Gage Rogers*, Director of Robin Hood's Barn, a Camp School for Children with Cerebral Palsy, and *Leah C. Thomas*, Director of Therapeutics at Robin Hood's Barn; formerly Associate Professor of Hygiene and Physical Education, Smith College; formerly Director of Corrective Exercises under the Direction of Dr. Joel E. Goldthwait and Dr. Robert B. Osgood, Boston, Mass. Cloth. Price, $2.50. Pp. 167 with 11 illustrations. New York: The Macmillan Company, 1935.

Cerebral palsy affects one of the largest groups of crippled children. The authors in this book show that owing to the nature of the handicap in these patients, their problems are difficult to overcome and that from birth they have less chance for mental, physical and social adjustment to their handicap than the average cripple. At Robin Hood's Barn it is shown that through their first fifteen years emphasis on the educational side and social adjustment will fit them to meet situations of adult life, which is far more useful than making physical accomplishments their outstanding goal. The authors believe that the secret of success in the education of children with cerebral palsy lies in the stimulus of succeeding. Because of the nature of their handicap they should be rescued from situations which bring about frustration of effort and inevitably lead to discouragement. This book should be in the possession of every physician, physical therapy technician, teacher and parent who is trying to help the young patients suffering from cerebral palsy.

THE DIAGNOSIS AND TREATMENT OF DISEASES OF THE PERIPHERAL ARTERIES. By *Saul S. Samuels*, A. M., M.D., Chief of the Clinic for Peripheral Arterial Diseases, Fourth Division, Bellevue Hospital, New York; Chief of the Department of Arterial Diseases, Stuyvesant Polyclinic Hospital, New York. Cloth. Pp. 275 with 51 illustrations. Price, $3.50. New York: The Oxford Press, 1936.

The present work exemplifies the cyclic interest in certain diseased states and emphasizes the oft repeated generalization that time finds the remedy. Samuel's contribution is not only timely but contains the very remedy that has long sought recognition in the court of scientific medicine. It will appeal to every one interested in the diagnosis and treatment of peripheral circulatory diseases not only because it has been written by one who has long labored in this field, but because it emphasizes the "necessity of intelligently correlating and combining various fundamental and proven procedures for the attainment of the best therapeutic results." While it is true that much has been accomplished by use of the modernized "boot," it is also true that the successful therapy of peripheral vascular diseases still depends on the care of one who is thoroughly oriented in the subject. The author has veritably boiled down a mass of valuable information for the benefit of the general practitioner, surgeon, orthopedist, internist, neurologist and the physician primarily interested in the factors of compensation and disability. In the space of ten chapters there are reviewed methods for differential diagnosis of thromboangiitis obliterans, arteriosclerosis obliterans and the other forms of vasospastic diseases by means of objective and subjective symptoms. A special chapter reviews the value of oscillometric tracings and presents quantitative information concerning the pulsations of the peripheral arterial branches. It discusses indications for amputation in diabetic and other forms of gangrene, emphasizes the value of certain operative procedures, and the technic used by the author. It particularly clarifies the diagnosis of incipient conditions and outlines the therapeutic procedures along the most practical lines. One notes that the author unequivocally advocates the deep heating benefits of diathermy, but is rather vague, cautious and dependent upon other authorities for his opinions on short wave diathermy. It would have better served the ends of his thesis had he discussed this phase of thermotherapy with the same vigor and dogmatic authority as when he reviewed his negative experiences with baking. With a few minor exceptions, the work as a whole is authoritative and critical in tone and timely in presentation. It is therefore not difficult to predict that this book will be warmly received by all who seek the latest information on the treatment of peripheral diseases of the arteries.

AN INDEX OF TREATMENT. By Various Writers. Edited by *Robert Hutchison*, M.D., LL.D., F.R.C.P., Consulting Physician, London Hospital and Hospital for Sick Children. Eleventh Edition. Revised. Cloth. Price, $12.00. Pp. 1020 with 147 illustrations. Baltimore: William Wood & Company, 1936.

This is a companion book to the three volumes already issued on symptomatology, diagnosis and prognosis. The first edition of this volume appeared in 1907. As this is the eleventh edition, the intention of the editors to provide the general practitioner with a guide to treatment in moderate compass and in a form convenient for reference has apparently succeeded. The contributors are all those of special experience in their fields. The subject of physical therapy is thoroughly covered. Charles W. Buckley writes on hydrotherapy; Elkin P. Cumberbatch on atmospheric treatment, massage, photo-

therapy and thermotherapy, and Leonard Williams on health resorts. Under the treatment of many special diseases physical therapy is considered in detail. Sir Henry Gauvain gives an excellent discussion of heliotherapy and artificial light treatment in surgical tuberculosis. In the treatment of hemiplegia, passive movements, mechanotherapeutics, massage and muscle re-education are considered in detail. This volume offers the general practitioner an excellent outline of simple and effective treatment. Elaborate and difficult operations are not described but non-operative treatment and minor or emergency operations have been dealt with in detail.

TUBERCULOSIS. By *Gerald Webb*, M.D. Former President National Tuberculosis Association; Lecturer on Medical History, University of Colorado; President, Colorado Foundation for Research on Tuberculosis. Cloth. Pp. 205 with 17 illustrations. Price, $2.00. New York: Paul B. Hoeber, Inc., Medical Book Department of Harper Brothers, 1936.

It is of unusual interest in this history of tuberculosis to learn that the first ossuary relics of Pott's disease date back to the dawn of civilization, the Neolithic period (5000 B. C.), when man first domesticated animals. That heliotherapy was used for this condition in early times is suggested in one of the illustrations of a prehistoric day statuette, appearing to date from 4000 B. C. It is suggested that the subject is portrayed taking a sand bath in the sun, a custom which still prevails in Nubia. In pre-Columbian bronzes from Peru, in effigy water bottles from the Indian burial grounds of many of our states, and from the pictographs of the cliff dwellers, the unmistakable picture of Pott's disease is portrayed. The individuals portrayed have paralysis of the legs and are usually lying on their backs playing the flute, a suggestion of occupational therapy. This volume contains many references to physical therapy, some of them bizarre, as the treatment advocated by Cato, the Elder. He was the great exponent of cabbage for phthisis, and a lukewarm bath of urine from a person who had eaten cabbage was considered the infallible cure. This volume forms an excellent addition to the Clio Medica series of handbook primers on the history of medicine.

PHYSICIAN, PASTOR AND PATIENT. By *George W. Jacoby*, M.D., Past President of the American Neurological Association and the New York Neurological Society. Cloth. Price, $3.50. Pp. 390 with 20 illustrations. New York: Paul B. Hoeber, Inc., Medical Book Department of Harper Brothers, 1936.

The author has devoted many years to the study, practice and teaching of neurology and psychiatry and hence his opinions have that authoritative tone commanding serious consideration. He has come to believe that if the physician and the clergyman are liberal minded and progressive they will agree on many points found in that uncharted borderland of neuropsychiatric disturbances, which require the practical cooperation of both in order to bring about better health — physical, mental and moral — for the patient. The book is divided into four parts: The physician's calling; religion and the patient; vital problems confronting the physician and the clergyman; and where medicine and religion join hands in every day life. The second part contains an interesting history of medicine and health in relation to various religions. A partial list of the chapters in part three illustrates the scope of the subjects covered. These deal with contraception and artificial abortion; recent advances in birth control; is every suicide insane? How shall we solve the divorce problem? Is the criminal sick or sinning? Sterilization and sterilization laws; sex and sex education; the euthanasia problem; and professional secrecy. Every physician has a sense of religious feeling and a reverence for a Creator and because he possesses this undefined but definite conviction that the things within and about us cannot be explained by formula and dogma, he will find this splendid book inspirational in character. It is therefore worth reading as it discusses many of the problems that involve the question of religion and its relation to medical practice. There is more to health and human happiness than can be weighed in the scales of the laboratory, a fact best appreciated by the perusal of such a broad and critical work as presented by Jacoby.

INTERNATIONAL ABSTRACTS

Electrosurgical Obliteration of Gallbladder Without Drainage. Max Thorek.

Am. J. Surg. **32**:417 (June) 1936.

A method of electrosurgical obliteration of the gallbladder is described which when carefully followed may be used in simple and complicated cases of gallbladder disease without resorting to drainage. It reduces mortality to a minimum and lowers hospitalization. The age factor loses its terror. Shock is absent. Failures in classic cholecystectomy are frequently due to bile leakage, as a result of the inability to obliterate and cover the gallbladder bed. Drains invite bile seepage. The procedure advocated by Thorek seals these openings by electrocoagulation. A sterile, hyaline, dry protective layer is substituted for a raw, unprotected surface. The falciform ligament is superimposed over this area. Drainage is entirely omitted.

The author's technic should not be confused with mucoclasis. The latter utilizes the cautery or diatherm fulguration, which aims at burning or carbonizing the mucous membrane of the gallbladder, or with so-called electrical or "electrocholecystectomy" where the diatherm cutting knife is used. Experimental studies have shown that any method of carbonization, as fulguration, Paquelin and electrocauterization predisposes to hemorrhage, thrombosis and embolism. Such cauterization will not destroy pathogenic microorganisms in the depths of the affected gallbladder wall. Cholecystelectrocoagulectomy is free from these drawbacks and effectually accomplishes destruction of the entire thickness of the gallbladder wall and if indicated, also the gallbladder bed. The surgeon has under control the degree of penetration he wishes to accomplish.

The ligamentum falciforme hepatis is used as a free graft serosal structure in covering sutured or raw surfaces to great advantage, thus reinforcing and protecting the areas concerned against seepage and safeguarding the processes of repair.

Electrocoagulated areas of intra-abdominal organs tend to heal by encapsulation. They do not interfere with wound healing. On the contrary they heal promptly when the wound is closed securely. Therefore, drainage is not only undesirable but is distinctly deleterious. In the last series of cases Thorek used short wave electrocoagulation with gratifying results. It eliminates many drawbacks (no grounding of patient, precise coagulation, etc.) of the diatherm apparatus usually used.

Galvanic Ionization Therapy in Allergic Rhinitis as Employed at Manhattan Eye, Ear and Throat Hospital. Henry A. Barrett.

Laryngoscope **46**:262 (April) 1936.

The actual results may be divided for simplicity into immediate effects, that is, within a period of two or three weeks following the treatments, and the later results. As stated before, the degree of reaction varied considerably on the whole, but only in a small percentage could it be called severe. During the second and third week most of the patients felt distinctly better. There has been less sneezing, the amount of secretion was reduced, breathing through the nose was easier, and life was much more tolerable. In a few cases, however, there was very little, if any, change for the better. This is especially true of patients suffering from an associated sinusitis. About ten of the cases have been treated so recently that we cannot form any opinion about the result of ionization as yet. Of the remaining 35 most of them have been seen within recent weeks, and in a fair number of cases considerable benefit has been derived. Two of them are symptom free; one, the first case that we treated, having suffered for twelve years. In a few of the cases no benefit, either immediate or late, was derived.

A Review of Infra-Red Photography. J. B. Feldman.

Arch. Ophth. **15**:435 (March) 1936.

Photography can be arbitrarily divided into three types: Regular photography; roentgenography, which portrays the bony structure, and infra-red photography, which deals with the subsurface area. As a new venture, infra-red photography has accomplished great strides. Sharp definition of the structures cannot be obtained. However, in ophthalmology a good idea of the contour of the pupil and its size, shape and position as seen through a dense cornea is obtainable. The presence or absence of occlusion by synechiae may be noted to advantage. Infra-red photography is valuable for the measurement of the size of the pupil in studies of dark adaptation.

Obliterative Vascular Disease. J. Herbert Conway.

J. A. M. A. **106**:1153 (April 4) 1936.

The introduction of passive vascular exercise in the treatment of obliterative vascular disease has stimulated renewed interest in the care of patients suffering from symptoms due to impaired peripheral circulation. Rhythmic, gradual change from negative to positive pressure augments the flow of blood through an extremity just as effectively as does rhythmic sudden al-

ternation in environmental pressure and does so without danger of injury to the intima of the vascular network, the vessels of which have already undergone some degree of sclerosis and thrombosis. Passive exercise was given for a period varying from three to six months to the thirty-six patients constituting a group of cases, which according to opinions expressed by earlier writers could be considered ideally suited for this treatment. It is believed that the high percentage of good results obtained in the cases reported can be attributed to the careful choice of patients for treatment.

Short Wave Radiotherapy in Vincent's Infection. C. E. Allen.

U. S. Nav. M. Bull. **34**:376 (July) 1936.

Since conventional therapy has proved either faulty or useless, the treatment adopted at the Dental Medical Corps (U. S. A.) clinic consisted in the following procedure: (1) The first treatment of the patient consists of removing the local irritants, such as calculus and debris, from the teeth and gum tissue. (2) Through the courtesy of the out-patient clinic, which is equipped with a short wave radio emitter, we have been able to use this form of therapy in conjunction with our other treatment. The patient is given a short wave diathermy treatment of 15 minutes' duration and advised not to use tobacco, alcohol, spices, or any irritants. A suitable diet and hygienic method of living is prescribed. The patient continues to get two short wave radio treatments daily over a period of one to three weeks, depending on the initial progress of the disease. About twelve hours after the first treatment the patient is comfortable and free from pain in the gums and cervical lymph glands. After the second treatment corrective measures such as filling carious teeth, removing overhanging margins on fillings, and the like, can be accomplished. Within a few days the marginal slough has disappeared from the gums and bleeding has ceased, and in a week the patient is greatly improved and well on the way to recovery. In the six cases that have been treated at this clinic with short wave diathermy, none will require treatment for peridontoclasia.

Electrolytic Method of Treating Detachment of the Retina. J. Cole Marshall.

Proc. Roy. Soc. Med. **29**:53 (Nov.) 1935.

The unipolar or katholysis method of Vogt, makes use of a very thin, long steel needle, attached to the negative pole of a galvanic apparatus. After the sclera has been prepared in the usual way and the position of the tear marked out, the anode (which can be in the shape of the Larsson ball) is placed on the surface of the eyeball a few millimeters from where the punctures are made. The current is turned on and the long needle pushed through the sclera deep enough to reach the retina. This can be done, according to Vogt, many times without serious loss of vitreous. The current is approximately 2 ma. and about a second in duration. One aims at surrounding the tear with punctures and also puncturing the actual area of the tear itself. The advantages of katholysis are that it does least damage as compared with the great heat of cauterization by the ignipuncture of thermocautery. Caustic potash destroys the tissues in an uncontrollable way. Diathermy, with its current of 50-100 milliamperes, causes burns and pierces the retina in a dangerous way, whereas the electrolytic needle which has all of its current at the tip, does not harm the retina by causing artificial holes.

Other methods produced scar membranes, secondary holes, opacities of the lens and optic neuritis; these have not occurred with the electrolytic form of operation. Very small amounts of vitreous were lost compared with other operations. The needle can be passed into the eye many times without danger, provided the suggested low amperage was used and the application lasting not more than a second. This method may also be used for localization of tears before multiple punctures are made. It is very useful in large bulbous detachments and where the retina had become very opaque. The method is simple and harmless; it is performed in a short time, provided the eye has been prepared the day before and the cornea is kept clear during the operation. Vogt used no corneal anesthetic but depended on the deep injections. Comparing the electrolytic method with other methods for the treatment of detachment of the retina, one of the great advantages is that the operation can be carried out absolutely apart from any special electric current. Also, the complicated diathermy machine is done away with. From Szily's paper it seems that even though a strong current is used no harm arises, whereas this is not always the case with diathermy methods.

Treatment of Carbuncle With Short Wave Diathermy and Cautery Puncture. Morris Fellman.

Am. J. Surg. **32**:467 (June) 1936.

The fact that striking symptomatic relief occurred, the clinical course shortened and apparent systemic complication avoided has prompted the use of short wave diathermy and cautery puncture in the treatment of three cases of carbuncle of the neck. In two, despite the actual inflammatory lesion, pain was the chief complaint and its relief within thirty minutes after the application of high frequency therapy without the use of sedatives is worth recording. The frequently mentioned contraindication in acute non-draining infection was also kept in mind and to meet this condition the use of cautery puncture to convert the non-draining into an externally draining cavity was adopted. In addition, the cautery was selected so that all vascular supply would be sealed off and the possibility of open blood spaces that might occur with incisions was eliminated.

The technic of the treatment is as follows: A cable is attached to the short wave machine and

is given three turns at the center so as to form a circle, large enough to extend beyond the margins of the lesion. Several thicknesses of toweling are placed over this and the patient is instructed to lie down in such a manner that the carbuncle occupies the center of it. The current is turned to the point of comfortable heat tolerance and the treatment is kept up for fifteen or twenty minutes either once or twice in twenty-four hours. The carbuncle is carefully inspected each day and as soon as any point of fluctuation is seen this is drained by puncturing with the actual cautery. No anesthesia is required as the tissues at this spot are usually so insensitive or desensitized that the patient scarcely perceives the cautery thrust.

Bactericidal Effect of Ultraviolet Radiation on Escherichia Coli in Liquid Suspensions. Alexander Hollaender, and Walter D. Claus.

J. Gen. Physiol. **19**:753 (May 20) 1936.

The irradiation of bacteria in liquid suspension has been made possible through (a) the use of a specially balanced physiological salt solution which is practically nonabsorbing for the wavelengths used, and which is of such composition that subsequent dilution of the bacterial suspension gives the proper number of organisms; (b) special design on the exposure cell and a very thorough method of stirring which subjects each organism equally to the radiation; (c) practically complete absorption of the incident radiation, through the use of very dense suspensions, thus eliminating the necessity for a separate determination of the absorption coefficients of the bacteria for the wavelengths used. The method also provides a means for determining the effects of sublethal doses.

The particular mechanism by which ultraviolet radiation inactivates bacterial cells is a question under considerable discussion. The effect has been attributed to the action of the radiation on the suspending material, on the cell wall, on enzymes in the organism, on the colloidal structure of the cytoplasm, and on nuclear material or material which controls cell division. Probably, however, the mode of action is very complex, involving several or all of these factors. Functions other than cell division are affected by "sublethal" doses of radiation, and if a number of them are involved in inactivation, it is obvious that no very simple explanation will suffice. One fact which stands out, however, is that the absorption curve and the sensitivity curve for S. coli both have a broad maximum at about 2650 A.; i. e., the wavelengths most highly absorbed (at least in the band 2400 A. to 3000 A.) are also the most efficient in producing lethal effects. The mere process of absorption is not equivalent to the process of killing, for then the killing would be proportional to energy absorbed for all wavelengths. Herein perhaps lie our most significant clue to the mechanism of the action of ultraviolet radiation, when the problem is finally solved.

Fundamentals of Allergic Rhinitis with Particular Reference to Ionization Iontophoresis. L. W. Dean.

Ann. Otol., Rhinol. & Laryng. **45**:326 (June) 1936.

Allergic rhinitis is a most important etiologic factor in nasal sinusitis, and if it is not controlled the infection of the sinuses will persist. The most important thing in the treatment of allergic rhinitis is a proper diagnosis. With all the information secured it is possible to outline a course of treatment and make a reliable prognosis. Many poor results are due to the fact that a thorough study is not made or because the physician uses only one type of therapy. The patients with allergic rhinitis observed by the author and his associates are mostly of the perennial type. While these patients have had good subjective results their noses have not returned to normal. An outline of the author's method of studying suspected cases of allergic rhinitis is given. The history is a most important consideration and yet in evaluating the history one must use common sense. In all cases of acute allergy the dates on which the patient had the acute upsets is most important. A study of the contacts on these dates may solve the problem. The nose and throat must be studied, because the treatment of almost every case of allergic rhinitis consists of the pathology in the nose plus a proper immunologic therapy. A person who suffers from ragweed hay fever may have, during the winter, symptoms of allergic rhinitis. Patients with atrophic rhinitis do not suffer from hay fever, but the nasal mucosa undergoes only the most moderate swelling and there is no nasal blockage. The fundamental allergic status of the individual persists regardless of the procedure used to get the desired result. In every suspected case of allergic rhinitis smears prepared from the nasal discharge should be studied. The relationship between eosinophils in the nasal discharge and allergic rhinitis has been studied and the results tabulated. A blood count should be made with particular reference to the number of eosinophils present. Dietary deficiencies must be considered. Malnutrition by decreasing the resistance of the cells of the mucous membrane to the entrance of allergens into the tissues and trauma of the epithelial cells are important factors in the sensitization of the organism. Endocrine disturbances should be sought for and corrected. Skin tests are made in every case. Patients may remain skin sensitive for many years. Intramucosal tests are now being made and compared with skin tests. More dependence is placed on the intramucosal test than anything else in determining the allergic status of the nasal mucosa. The best way to get a definite knowledge of the systemic allergic status of an individual is to make a passive transfer test. Tests should be made of bacterial allergy. Multiple sensitivity is the rule in allergic rhinitis. The leucopenic index of Gay and Ritter has proved to be of great value as an exact procedure in the study of food allergy. There is a non-allergic type of

vasomotor rhinitis. When ionization is performed, zinc enters the tissues as was demonstrated by Wenner. Ionization acts by thinning and splinting the mucous membrane. A biopsy from a human nose ionized three months before has shown areas of perfectly well developed ciliated cells. A common result of ionization, which lasts at least two years, is a thickened and more dense basement membrane. The mucous glands of the membrane undergo hyperplastic changes. There occurs a more or less complete paralysis of the parasympathetic nervous mechanism of the nose. Wenner had demonstrated in the web of a frog and in the ear of a rabbit the slowing of the blood stream in ionization.

The final results of ionization of the human nose as observed by the author are given. With the change in the epithelial lining and the interference with the secretion of nasal discharge, together with the formation of a thickened and more dense basement membrane, the absorption of pollen is interfered with. With changes in the membrane, one would hesitate to do repeated ionizations.

Ionization does improve most cases of allergic rhinitis. The less the sensitivity to allergens, the greater the relief. Ionization does produce deleterious results in the mucous membrane of the nose which lasts at least two years. Many changes are permanent. According to the author there is no excuse for using ionization if procedures that do not produce deleterious results will give a satisfactory response. Ionization should not be used unless the benefits derived are greater than the deleterious results produced.

Frequency and Effect on Eustachian Tube of Residual Lymphoid Tissue in the Nasopharynx. Dunbar Roy.

Arch. Otolaryng. **24**:325 (Sept.) 1936.

That the lymphoid tissue in the nasopharynx occasionally involves the eustachian tube, both by its blocking effect and by its being the source of infection for the middle ear is well recognized. This, in the opinion of the author, accounts for the lessened frequency of involvement of the middle ear since there has been such universal removal of tonsils and adenoid tissue. The paper deals with cases in which operation has previously been performed and remnants of this lymphoid tissue either still remain around the nasopharyngeal opening of the eustachian tube or have undergone compensatory increase in size. These compensatory enlargements are analogous to the enlargement of a kidney when the opposite one has been removed or the phenomenon after the removal of one adrenal gland. Lymphoid tissue which obstructs the mouth of the eustachian tube is most frequent in the very young; whether or not lymphoid tissue actually occurs in the eustachian tube has by no means been settled. The author with the nasopharyngoscope has found lymphoid tissue apparently in the mouth of the tube itself — and this usually several years after removal of tonsils and adenoids. In the rapid routine of office practice the physician too often fails to make a thorough examination of this part of the nasopharynx and for this reason one is sometimes surprised at not obtaining the desired results from inflation with the catheter. Many examiners have seen particles of lymphoid tissue left after operation, which in a few years result in the return of the adenoids, and one is faced with the necessity of advising a second operation. While the effect of this lymphoid tissue on the eustachian tube must be considered, the problem of the method of treatment which is most applicable to the condition has frequently presented itself. The author rejects the use of surgical instruments because they usually cause irreparable damage or are otherwise inadequate. The use of the galvanocautery and surgical diathermy has been advocated by certain workers, but in his hands, Roy has found chemical cauterization most satisfactory for the destruction of lymphoid tissue located around and inside the tubal orifice. The technic is described. While such a method is admittedly slow it is safe and will finally destroy small particles of lymphoid tissue at these points. Roy believes that many aural conditions could be permanently benefited if every laryngologist considered more frequently the possibility of the presence of lymphoid tissue in and around the nasopharyngeal opening of the eustachian tube.

Heat Regulation in Dementia Praecox. Isidore Finkelman, and W. Mary Stephens.

Am. J. Psychiat. **92**:1185 (March) 1936.

The reactions to extreme cold of a group of 50 patients with hebephrenic dementia praecox were observed. The oxygen consumption rates, temperature readings, blood sugar determinations and pulse, respirations, shivering and other responses were noted before and during exposure to water at 60 F. and during rest in bed after the bath. These reactions were compared with those observed in nonpsychotic subjects and in a group of chronic encephalitics exposed to the same experimental conditions. The patients with dementia praecox react to cold as a group with a lower heat production than the normals.

Schizophrenics do not have any respiratory shock on immersion in cold water, as a rule. This transient respiratory phenomenon was observed in most of the normal subjects. In schizophrenia there was an absence of, or a very slight shivering response. Many of the non-psychotic subjects shivered, and some, very intensely. There was no significant change in the blood sugar level in any of the groups, indicating that epinephrine, at least in human subjects, does not play a role as a calorigenic agent on exposure to cold. Many of the reactions were similar to schizophrenia and in postencephalitic parkinsonism. It can be concluded that in dementia praecox there is a low heat production in response to cold. The heat production is not maintained after exposure and there is no reactive hyperemia. Evidence is adduced that there is a physiologic disturbance in the hypothalamus in schizophrenia.

TREATMENT OF CHRONIC MENINGOCOCCIC INFECTIONS BY ARTIFICIAL FEVER *

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OMAHA, NEBR.

The value of artificial fever therapy by physical means in gonococcal infections has been well established. Sustained body temperatures of 106.8 degrees F. destroy at least 90 per cent of the strains of gonococci within 8 hours.[1] Experimental evidence[2, 3] indicates that the spirochaeta pallida can also be destroyed by temperatures that the body can withstand. Extensive thermal death time studies upon other common bacteria have so far not indicated that artificial fever might be curative.[4]

The morphologic and biologic similarity between gonococci and meningococci led us to experiment with thermal death time studies of the latter organism. Our observations so far obtained by water bath studies indicate that these organisms likewise can be destroyed by heat which the body can safely tolerate. Thermal death time studies by the extinction method are apt to be unreliable for any organism that does not grow readily upon ordinary culture media. The meningococci seem to be very heat labile when first transplanted to broth media, but become more heat resistant through each successive generation upon a given medium. This phenomenon makes it difficult to set a standard death time for a specific strain. In general, however, we have been able to destroy most of the strains at 41.5 degrees C. (106.8 degrees F.) within 8 hours.

Laboratory findings as yet are merely suggestive in character. The extinction method for determination of thermal death time was used because it adapts itself to the effect of sustained heat at a given temperature for a definite length of time.

Description of Method

Apparatus. — We have used a Freas Electric Constant Temperature Bath for all determinations. This apparatus was constructed to maintain a given temperature within a variation of 0.2 degree C. By the use of a turbine stirring device we were able to keep the temperature variations well within these limits. A standard incubator was used for culturing all organisms. Stock cultures were maintained on 5 per cent glucose agar slants. Glucose hormone broth and glucose hormone agar were used in all determinations of thermal death time.

Technic. — Transplants were made from stock cultures to glucose hormone broth. The broth cultures were incubated for 48 hours or until 3 plus turbidity of the broth was obtained. The water bath was adjusted to 41.5 degrees C. (106.8 degrees F.) and flakes containing 100 cc. of hormone broth were immersed in the bath. It was found that 30 minutes was required for the flasks to reach the temperature of the surrounding water. We then transferred 1 cc. of the broth culture to the immersed flasks and mixed well. Time determinations were begun at the minute of transfer. Specimens of 1 cc. each were then taken from the flask and transplanted on hormone

* From the University of Nebraska Fever Therapy Research Department. Presented in part at the 87th Annual Session of the American Medical Association in the Scientific Exhibit, May 11-15, 1936.

broth and on hormone agar poured plates to determine the original concentration of organisms. Hourly specimens were then withdrawn in like manner and again transplanted on hormone broth and agar. These cultures were incubated at 37.5 degrees C. for 48 hours before the first reading. If the strain was difficult to cultivate on laboratory media the initial reading was taken after 96 to 120 hours of incubation to avoid the possibility of overlooking a late growth.

The accompanying graphs (figure 1) are based solely upon poured plate determinations. In those instances where the growth on broth seemed inconsistent with one on poured plates, the tests were repeated; that is to say, the degree of turbidity in broth cultures served as quite reliable indication of the plate counts. Cultural idiosyncrasies and Gram stains were ordinarily sufficient to rule out contaminants. The results of thermal death time experiments have been determined in about 60 strains of meningococci. These will be published elsewhere at a later date.

The Kettering Hypertherm * or air conditioned cabinet method of artificial fever therapy is used in our clinic. This method of fever induction has been extensively described elsewhere.[5] In the University of Nebraska fever research department we have treated to date over 400 patients taking over 2,000 fever treatments.

Case Reports

The following observations first stimulated our interest in the possible clinical value of fever therapy in meningococcic infections, and finally led to its application in two chronic meningococcemic patients with cures in both instances:

Case 1. — Miss P. R. B., aged 7, was admitted to the service of one of the authors (A. E. B.), February 4, 1935, suffering from early meningococcic meningitis. The patient came from a community having an epidemic. Three other patients from the same neighborhood were under treatment at the time. The patient was seen very early in the disease, having a generalized petechial rash, neck rigidity, headache and a temperature of 103 degrees F. The spinal fluid was cloudy, with cell counts ranging from 650 to 855 per cmm. Smears revealed 84 to 88 per cent polynuclears, but no organisms were demonstrated. Two intraspinal injections of antimeningococcic serum were given.

Because of persistent vomiting and headache suggestive of cerebral edema, 250 cc. of 50 per cent glucose was given intravenously on the second day. At that time the patient's temperature was 105 degrees F. A chill followed the injection and the fever mounted to 109 degrees with a pulse rate of 200 per minute. The patient became deeply comatose, had generalized convulsions and was apparently moribund. The temperature remained at 109 degrees for one hour and above 108 degrees F. for 2 hours thereafter. By the use of ice packs, cold enemata, electric fans and fluids the heat stroke was gradually alleviated. By the following morning the temperature ranged from 101 to 102 degrees F. The spinal fluid cell count dropped to 230, 85 and 22 on the following consecutive days. The patient was dismissed on the 12th day without further serum therapy.

Comment. — The unusual febrile reaction following an intravenous injection which came nearly being fatal, seemed to have sterilized the meningococcic infection. Following this dramatic experience we began our thermal death time studies upon various strains of meningococci. Shortly after this a patient with chronic meningococcemia was referred to the fever therapy department by Drs. J. J. Keegan and George Pratt. This patient came from the same epidemic community as the one above described.

Case 2. — Mr. P. K., aged 25, in June and July, 1935, complained of general malaise and anorexia associated with an afternoon temperature ranging from 101 to 102 degrees F. He was admitted for observation in August, 1935. One week after admis-

* We are indebted to Mr. Charles F. Kettering and Dr. Walter M. Simpson for the loan of the cabinets in our research studies.

sion the patient had a chill, with sharp temperature rise, neck rigidity, vomiting and headache. A spinal puncture showed normal pressure, but a cloudy fluid containing 1,820 cells per cmm., of 80 per cent were polynuclears. No bacteria were found. The headache and neck rigidity subsided promptly following the drainage. The septic febrile course continued. All laboratory tests and cultures were negative for commoner bacteremic infections. The leucocytes ranged from 26,000 to 31,000 with about 80 per cent young forms. At first a careful search for suppurative foci in the paranasal sinuses was made with entirely negative findings. One month after admission a positive blood culture of meningococci was obtained. A tonsillectomy was done. Cultures of the nasopharynx were negative for meningococci. Acute meningeal symptoms recurred after the tonsillectomy. On the 43rd day after admission the spinal fluid revealed 6,200 cells per cmm., most of which were polynuclears and the meningococci were cultured from the spinal fluid at this time. After drainage the acute meningeal signs again subsided but the febrile course continued with temperatures up to 103 degrees F. The patient was started upon artificial fever therapy on October 11, 1935. Thermal death time studies upon cultures from blood and cerebrospinal fluid showed all organisms destroyed at 41.5 degrees C. within 8 hours. [See figure 1, strains I and II).

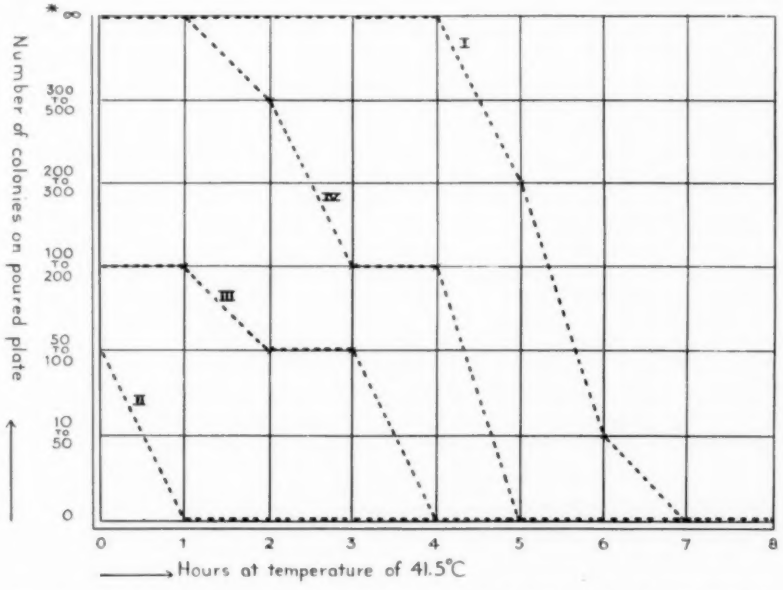

Fig. 1. — Graphic representation of thermal death time determinations of meningococci cultured from Cases 1 and 2. I — Strain from Blood Stream of Case 2 (Mr. P. K.); II — Strain from Spinal Fluid of Case 2 (Mr. P. K.); III — Strain from Blood Stream of Case 3 (Mr. R. S.), (Early Determination); IV — Strain from Blood Stream of Case 3 (Mr. R. S.) (Late Determination).

* Indicates Colonies too numerous to count.

Three artificial fever treatments were given at three day intervals for a total of fifteen hours above 106 degrees F. The fever was carried each time above 107 degrees and for short periods at 107.5 degrees (fig. 2). Following the first treatment the patient's temperature remained normal for two days and the headache entirely disappeared. Slight neck rigidity remained. After the second treatment the patient was entirely symptom free. A third treatment was given but probably was not necessary. The patient has remained entirely well. He was dismissed cured ten days after the first artificial fever session. The leucocyte count was 8,000 with 58 per cent polynuclears. Blood cultures were negative and the sedimentation rate was 18 mm. in three hours compared with 18 mm. in 20 minutes prior to the first fever treatment.

Comment. — There seemed to be little question that artificial fever therapy, administered in the manner used for gonococcal infections, proved to be effective for this case of chronic meningococcus infection. The patient had been under observation for a long period during which two attacks of acute meningitis were observed. No other therapy except a tonsillectomy was

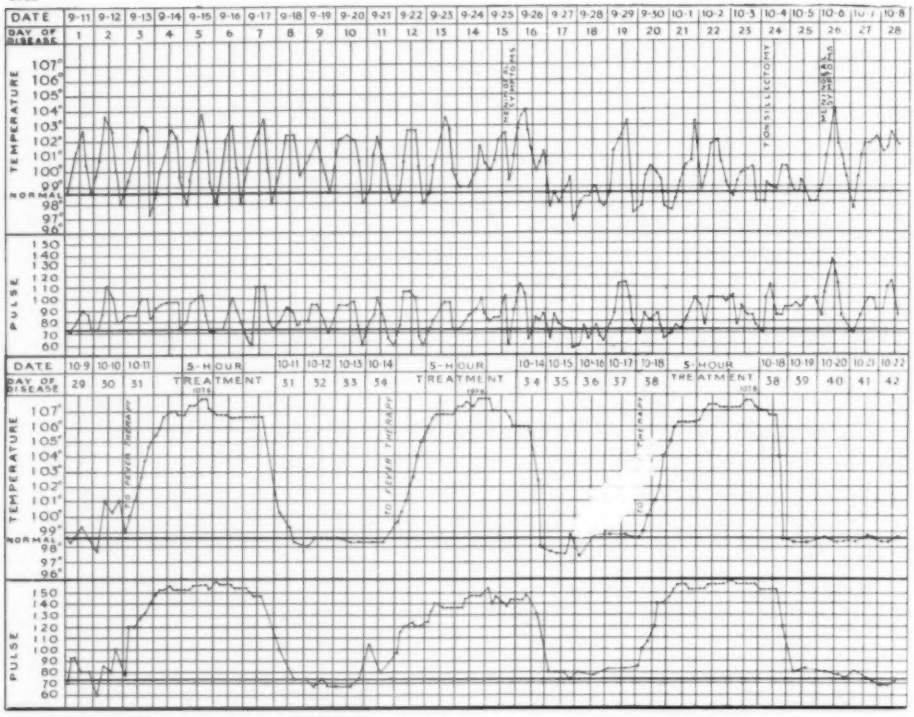

Fig. 2. — Fever-graph of Case No. 2 of chronic meningococcic infection and abrupt cessation after artificial fever therapy (15 hrs. 106-107.6 degrees).

administered and the patient showed no tendency toward spontaneous recovery. The entire course of the infection was stopped abruptly with the first administration of the artificial fever therapy. Thermal death time studies of organisms isolated from the blood and cerebrospinal fluid confirmed the clinical observation that the organisms could be destroyed by temperatures the body could withstand.

Case 3. — Mr. R. S., aged 48, was admitted to the hospital complaining of daily fever with chilly sensations, followed by profuse perspiration, skin rash, and loss of weight. Following exposure the patient had a chill, developed fever, and had been in bed for six weeks. Chilly sensations occurred daily in the late morning or early afternoon, followed by fever of 102 to 103 degrees F. After the first week of fever a papular eruption developed over the skin of the upper and lower extremities, abdomen and chest. These lesions became tender, persisted for a few days and disappeared, only to be followed by a new crop after another chill. During the chill and fever the patient developed pains in various joints. These pains left as the fever declined. The patient had lost about 30 pounds in weight. The past history was unimportant.

The examination revealed good nutrition but considerable body pallor. On the skin of the fingers, toes, chest and abdomen were several papular eruptions. These varied in size and were surrounded by erythematous areas which were tender to touch, and as they disappeared the skin desquamated. (There were no purpuric lesions.) The muscle tonus was poor. There was slight upper right rectus rigidity and prostatic hypertrophy. A complete examination gave no positive findings except those mentioned above. The admission temperature was 101 degrees F., pulse 88 and respirations 20.

Laboratory Studies. — Urine negative, except for a faint trace of albumen. Blood: Hemoglobin 90 per cent, erythrocytes 4,700,000; leucocytes 17,000; polynuclears 54; staff forms 32; lymphocytes 9; mononuclears 4. Three blood cultures taken during the first nine days proved sterile. Agglutinations for all the various pyogenic organisms were negative as were the blood smears. Blood sedimentation rates were very

rapid, 24 mm. in 35 minutes. Stool cultures showed a predominance of streptococci. X-ray studies of the teeth, sinuses and chest were negative.

Progress. — During the first two weeks in the hospital the temperature rose each day, following a slight chill, from 98.6 to 103 degrees F. (fig. 3). The skin lesions

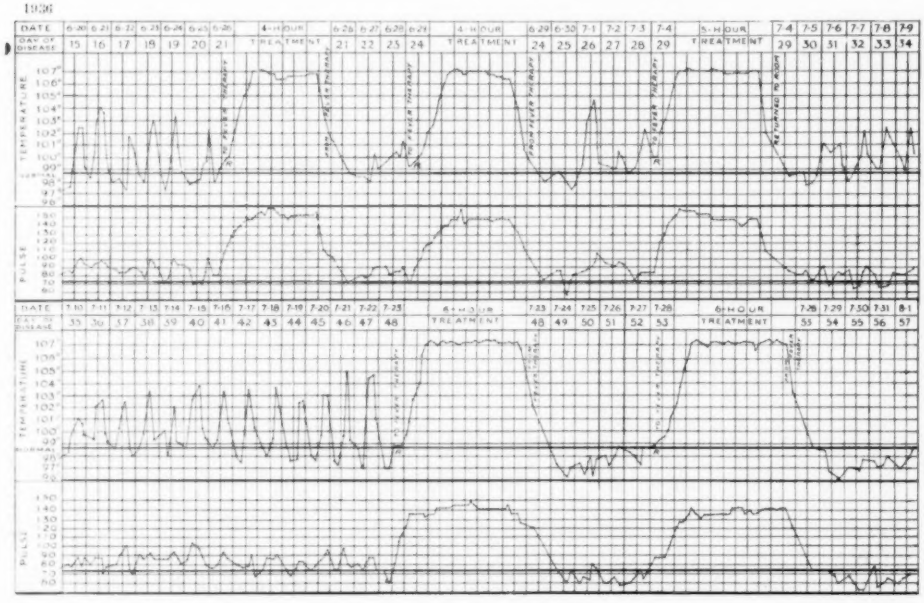

Fig. 3. — Fever-graph of Case No. 3 of chronic meningococcic infection — failure to control infection by three short artificial fever sessions (106-107 degrees), with cure after two sessions of six hours each at 107 degrees.

appeared and disappeared in crops, and as they were apparently embolic in nature, a fresh lesion was removed and cultured. After 48 hours' incubation a Gram negative diplococcus was obtained. This was transferred but the growth showed staphylococci which apparently were contaminants. Culture of the nasopharynx yielded a Gram negative diplococcus also, which in transfer was replaced by staphylococcus. There seemed to be some enlargement and tenderness in the upper right quadrant, but x-rays of the gall bladder and aspirations of duodenal contents upon culture were normal. The heart findings continued negative with a pulse rate slow in comparison to the febrile elevation. The clinical opinion at this time was a probable meningococcemia.

At this time intradermal injections of a meningococcus toxin were made and in 26 hours there was a positive reaction to a 1:10 dilution. At the end of three weeks of hospitalization with no significant new findings, it was decided to try fever therapy. The patient was given three artificial fever treatments at four day intervals, fever being maintained between 105 to 107 degrees F. for four hours on the first two treatments, and for five hours for the third treatment. The temperature remained normal for two days after each of the first two treatments, but the day following the third treatment a severe chill occurred and the temperature rose to 104.8 degrees F. Following the second treatment the leucocyte count fell to 8,000 with a marked shift to the right; the skin lesions ceased appearing for 10 days.

The temperature continued up to 103 to 105 degrees F. each day. Finally the fifth blood culture disclosed a growth after 3 weeks incubation but the organism, a Gram negative diplococcus, could not be definitely identified because of difficulties in culturing. The seventh culture grew in one week, and the eighth in 48 hours yielding a Gram negative diplococcus with the characteristics of the meningococcus. Agglutination tests at the University of Nebraska were made and the organism identified as a type I meningococcus and type III by Dr. G. W. McCoy, Director of the National Institute of Health. Thermal death time studies on this organism revealed that all cultures were killed on the water bath in four hours at 106.8 degrees F. (See thermal death time graph strains III and IV.)

On July 22, 1936, artificial fever therapy was again given. The body temperature was maintained at 107 degrees F. for 6 hours. Following this treatment the

temperature became normal and remained so for 5 days, when another fever treatment at 107 degrees for 6 hours was given (fig. 3). Following the first prolonged treatment the temperature remained normal, the sedimentation rate decreased to 18 mm. in 1 hour and the leucocyte count became normal. Blood cultures taken after the second prolonged fever treatment showed no growth, the sedimentation rate was 8 mm. in 1 hour. The patient was discharged 13 days after the first prolonged fever treatment with a normal temperature and has remained entirely well.

Comment. — It was difficult early to prove the diagnosis of chronic meningococcemia in this case. Attempts at cure with fever therapy were unsuccessful at first because insufficient fever was produced. After we isolated the meningococcus and determined a thermal death time of 4 hours at 106.8 degrees F., we obtained an accurate therapeutic guide. The second course of fever sessions maintained at 107 degrees F. for six hours was completely successful in sterilizing the infection. One should note that the presumptive discrepancy between in vivo and in vitro determinations was realized and the hours of fever above 106 degrees were prescribed accordingly.

This form of therapy in our opinion is still in the experimental stage and a large series of cases will have to be treated before we can properly evaluate its usefulness. We do not believe that it will replace serum therapy in acute meningitis. Our present judgment is that the treatment of acute meningitis by this method is contraindicated because of the danger of severe cerebral edema and medullary failure.[6] We believe that it may have a place as adjuvant therapy in subacute or chronic meningococcic infections not relieved by serum therpy, or in meningococcemic states such as the two reported cases. Frequently we see patients with meningitis running a low grade fever with increased pleocytosis after serum therapy, and one has difficulty in determining whether more serum is indicated. We hope to be able to treat these patients with artificial fever therapy as it is quite likely that the period of convalescence can be shortened.

Summary

We have presented for the first time experimental, laboratory and clinical evidence that sustained artificial fever at 107 degrees F., is effective against certain strains of meningococci.

Two cases of proved chronic meningococcic infections, one of which had two attacks of meningitis, have been cured by artificial physical fever therapy without other therapeutic procedures.

Thermal death time studies by the extinction method carried out upon a large number of strains of meningococci show that most of the strains die out on the water bath at 106.8 degrees F. within 8 hours.

We recommend further clinical trial of this method in subacute or chronic meningococcic infections, especially in cases of meningitis not responding to serum therapy. At present we feel that in the acute fulminating types of meningococcic meningitis fever therapy is contraindicated.

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(*Concluded on page 769*)

STUDIES OF COMPARATIVE DEEP TISSUE HEATING *

(Hot Air, Hot Water, Short Wave Diathermy and Electromagnetic Induction)

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and
WALTER BOWMAN, B.S.

CHICAGO

In the past studies to determine the comparative deep tissue heating efficiency of various agents, especially short wave diathermy by condenser and induction coil methods, have been carried out almost entirely by inserting a thermocouple into the tissues. Since this method always produces a certain degree of trauma and circulatory stasis at the very point the temperature is measured, it appears quite likely that the actual temperatures obtained are somewhat higher than in normal tissue with undisturbed circulation.

For this and other reasons, it seemed desirable to devise a simpler method by which the relative heating efficiency of various agencies could be established without traumatizing the tissues. It was reasoned that if heat be applied, say at the elbow region, a certain relative amount of the "deep heat" would be delivered into the arterial flow, and by it carried to the more distal portions of the limb, such as the hand. If this be so, the temperature of the hand should rise in proportion to the amount of "deep heat" delivered into the arm. The more superficially delivered heat would be taken on by the venous flow and carried towards the body.

The problem, then, confined itself to the manner of relatively measuring the amount of heat carried to the hand by the arterial flow. Our first attempt was to submerge the hand into a specially constructed calorimeter while heat was applied, and then note the rise in the water temperature per unit time. It was soon observed, however, that although this method might work quite satisfactorily in the case of short wave diathermy in any form, it was not practical in experiments with water, because in order to keep the hand submerged in the calorimeter, the arm must be kept in a suspended position, and hot water can then be applied to the elbow only by means of a cuff-like container around the arm. This would be quite undesirable since both the cuff as well as the water would tend to retard the circulation.

We then acted upon the suggestion of Dr. Kolin of Michael Reese Hospital, that a combination gas calorimeter-thermometer would be an ideal device to measure the temperature changes in the hand. The type tried out was constructed as follows: (1) a thin walled cylinder shaped glass bulb of sufficient size to permit complete encompassment by the hand; (2) extending from the upper end of the bulb, and at right angle to it, is a capillary tube about two and one-half feet long. A drop of distilled water was sucked into the capillary tube, and its movements to and fro in the tube, with the expansion and contraction of the gas in the bulb, would indicate the relative degree of heating and cooling of the gas. A T-tube valve between the water drop and the bulb permitted any necessary adjustments of the position of the water drop before starting an experiment.

This device was extremely sensitive and had the desirable advantage that the arm could be held in an horizontal position for the application of hot water to the elbow region. The major difficulty arose in the time-consuming procedure

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* Aided by a grant from the Council on Physical Therapy of the American Medical Association.

of standardizing the instrument and re-checking it for every experiment. It was then suggested by Dr. W. C. Pierce of the chemistry department, University of Chicago, that a Backman thermometer might function satisfactorily for the kind of test we had in mind. This instrument has a range of a little more than six degrees Centigrade, and can be read accurately to one one-hundredth of a degree. The zero reading on the thermometer can be set to correspond to any desired degree, and in our work was set at 31.7 degrees C. The mercury bulb has a dimension of about 1½×½ inches, a size quite convenient to be enclosed in the hand.

Method

The bulb of the thermometer was placed in the partly closed left hand. A small cotton wad was placed just below, and another, surrounding the neck of the thermometer, just above the bulb. As the hand was then completely closed, the cotton wads helped to protect the bulb from outside air currents and temperature changes. The outside of the hand was then wrapped in several thicknesses of cotton layers, which, in turn, were held in place by numerous wrappings of ordinary gauze bandages. With these precautions we felt that the bulb was sufficiently protected from outside influences, and that any temperature changes observed would be due to a rise in temperature in the hand proper.

The 15 meter shortwave energy was applied "cuff and cuff." The electrodes placed equidistant above and below the elbow, were about 4 inches wide and 16 inches long, thus completely surrounding the arm. The distance from the proximal edge of the upper electrode to the distal edge of the lower was about 10 inches. The metal electrode was separated from the skin by a layer of rubber slightly more than one-half inch thick, and one thickness of toweling. To inhibit heat losses from the portion of the arm interposed between the cuffs, additional layers of toweling were wrapped around it. In every experiment the milliammeter reading was 1200.

The electromagnetic coil was wrapped around the arm roughly 4 and ¾ turns, the diameter of the loops was about six inches, and the spiral thus formed extended over the same area of the arm to which the short wave was applied. The apparatus, a 25 meter machine, was set at full capacity.

The hot air was applied by means of an electric heating pad, the arm being first wrapped with two thicknesses of medium heavy fluffy toweling. Considering the flannel covering of the heating pad itself, the heating coils of the pad were thus separated from the skin by three thicknesses of fluffy material. In view of the low heat conductivity and high porosity of this material, the heat is transmitted from the coils to the skin chiefly by air convection, and then through the skin by conduction. No doubt, some heat is also delivered by radiation, but in view of the comparatively low temperatures of the coils, this amount is probably very small. The temperature of the air was taken by a mercury thermometer inserted between the pad and the toweling, and was kept at about 65 degrees C. This temperature was chosen for two reasons: first, it was very close to skin tolerance, and second, it was maintained quite uniformly by the heating pad used.

The water experiment was applied by bending the elbow sufficiently to permit it to become submerged into a vessel of water maintained at the desired temperature. The initial temperature of the water was about 40 degrees C. and it was then raised, within the first five minutes, to skin tolerance, slightly above 45 degrees C.

In order to ascertain the temperature effect of the heat application itself, it was obviously necessary to allow the thermometer to reach an equilibrium after it was placed in the palm as previously described. This required from 15 to 35 minutes depending on the individual, but it also varied with the same individual

at different times. The equilibrium point itself also differed with the individuals, as well as in the same individual at different times, but this must be expected in view of the known changes in the body temperature throughout the day. At least 24 hours intervened between any two tests on the same individual.

Finally, one more factor must be considered before drawing any definite conclusion as to the relative amount of deep heat introduced into the arm by the application; namely, the degree of rise in temperature induced in the hand by vasodilatation and increased blood flow alone. This we estimated by measuring the rise in temperature in the opposite hand, under similar conditions, and the data thus obtained are presented on a special graph.

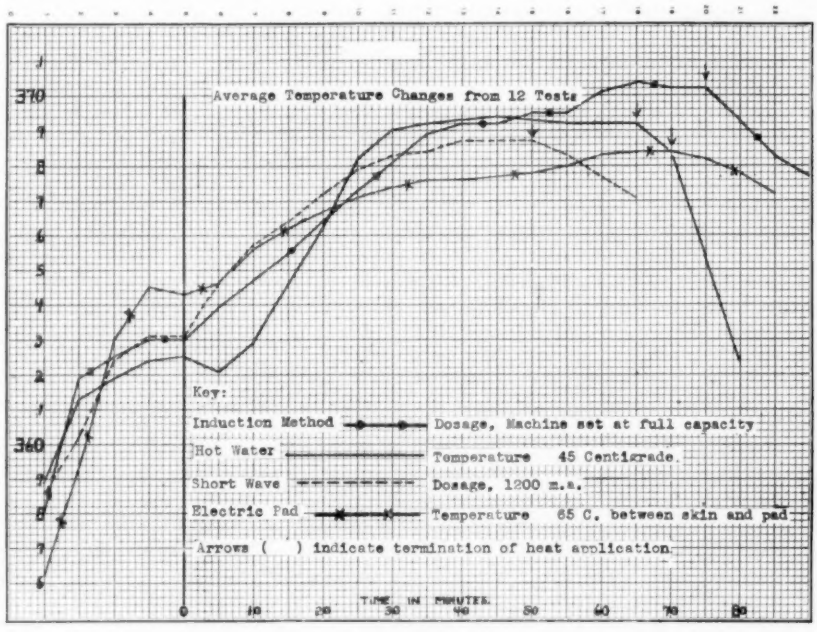

Fig. 1. — Legend incorporated in chart.

Results

The lowest equilibrium point obtained was 35.87, and the highest was 36.7 degrees C. — a difference of 0.83 degrees C. The greatest variation in one individual was 0.45, and the average of all the determinations was 36.32 degrees C.

The temperature elevations obtained were:

TABLE 1. — *Temperature Elevations by Thermic Agents*

Subject	1	2	3	Aver. Opp.*	Time**	
Short wave	0.40	0.90	0.40	0.57 (0.35)	40 min. [	45 min.]
Inductotherm	0.40	1.05	0.75	0.73 (0.28)	70 min. [	50 min.]
Water	0.50	0.80	0.90	0.73 (0.45)	55 min. [	40 min.]
Electric Pad	0.20	0.60	0.42	0.42 (0.22)	65 min. [	75 min.]
Individual Aver.	0.37	0.83	0.61	0.61 (0.33)	57.5 min. [	52.5 min.]

* Indicates the temperature changes obtained in the opposite hand.
** Indicates the time required to reach the highest temperature. The figures in brackets, show the time required to reach the highest temperature in the opposite hand.

Discussion

The following points seem to merit special attention: The electromagnetic coil gave the highest single rise, 1.05 degree C., with short wave and hot water as second place with a rise of 0.90, and the electric pad last, with a rise of only

0.60 degrees C. In the average-column, however, hot water is identical with the coil at 73 degrees C. It should be mentioned, however, that it was in the largest arm that the coil reached this maximum rise of 1.05 degree C. and that water reached its highest rise of 0.90 degrees C. in the thinnest arm, which is what one may expect, especially in the case of water, since it must deliver its heat by conduction.

In regard to the time element, we are unable to give any reason why the electromagnetic field required 70 minutes to reach its maximum rise against 40 minutes for the short wave, 55 minutes for the water, and 65 minutes for the electric pad. The proportionately longer time required by the hot air as compared with that of water is explainable through the great difference in heat capacity — about 1 to 3000.

It is of interest to note the temperature changes induced by reflex in the opposite hand. In the average-column of table 1, the electric pad is again low with an average of 22, with the coil at 28, short wave at 35, and water at 45 degrees C. That water caused the greatest rise is perhaps also to be expected in view of the fact the reflex action through which the blood flow is increased in the opposite arm, is probably chiefly initiated in the skin nerve mechanism of the heated arm; and there can hardly be any doubt but that the hot water exerts the greatest skin stimulation of all the agencies used. The greatest single reflex effect by the water was 0.65 degrees C.

It is to be regretted that conditions prevented determination of the temperatures in both hands simultaneously. As it was, at least 24 hours intervened between tests, and the physiologic conditions in the subject were therefore not always the same for each test.

Summary

An attempt was made to devise some method by which the relative deep tissue heating efficiency of various agents could be determined without inserting a thermocouple into the tissue. The method used was based on the theory that if heat be applied at the elbow region, a certain portion of the deep heat would be taken up by the arterial flow and detectable at the hand; the temperature of the latter in turn would rise in proportion to the amount of deep heat delivered.

Considering single results, the electromagnetic coil produced the greatest rise in temperature; short wave and hot water next in order; and the electric heating pad was lowest in the production of heat.

In regard to the time that elapsed to reach maximum temperature, coil technic required the longest; then the electric pad, and water, next in order, with the short wave involving the shortest time.

Temperature tests were also made on the opposite arm with the aim of determining the relative reflex effect of the agents used. In this, water proved most; short wave second; inductotherm third; and the electric pad least effective.

BIOLOGICAL SOURCES OF RADIOACTIVITY

Part II

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In 1931 we reported a series of experiments[1] intended to show that radiations capable of producing ionization in gas are emitted by plants, fruits, vegetables, animals and soil. Because our newly-found emanations produced ionization we regarded them as radioactive manifestations of some kind; but, as stated in the former paper, we made no specific identification of these rays more than to say that, "they are of the same nature as the *alpha* corpuscles and *beta* particles . . . . ."[1] leaving much to the results of future research.

What appeared at first to be rather simple phenomena proved to be much more involved than we had supposed, and in the researches of subsequent years we have been led far afield in our efforts to trace many of these observed phenomena to their ultimate end. Through concentrated effort new facts have been brought to light in support of the contention that not only does biologic matter give off radioactive emanations but several other types of radiations as well. And although scientists have believed for many years that some kind of biologic radiations existed, with the exception of the Gurwitsch and the infra-red rays, no conclusive proof seems to have been established prior to 1931 in support of biologic radioactivity.

Subsequent to 1931, however, not only have radioactive emanations been confirmed beyond doubt, but many other biologic radiations have been established; and at the present time among the biologic emanations we may include: Gurwitsch, or mitogenetic rays, infra-red and radon, as well as certain "Vital" radiations such as ultraviolet and chemiluminescence, which have always been supposed to be non-existent, or hidden from detection.

Considering the nature of biologic structure, that is, the atomic nature of living matter, it is not surprising that radiations exist; in fact, it would be surprising if they did not exist in one form or another. At the outset, however, it should be made clear that in biologic matter we have two distinct types of radiations, namely, (a) radioactive emanations, that is, those rays directly emitted by radioactive substances, such as potassium and rubidium, and from small but definite quantities of radium, the measurement of which is obtained by removing and measuring the radon which is in equilibrium with it; and (b) biologic radiations, that is, those radiations which are the direct result of biologic function, such as the Gurwitsch, infra-red, ultraviolet and other rays.

The space at our disposal will not permit of discussing radiations resulting from biologic function, but we shall endeavor to bring the subject of biologic radioactivity down to date, leaving the subject of "Vital" radiations for future papers.

Early Experiments in Radioactivity

There are no records available of successful attempts having been made prior to 1931 to establish biologic radioactivity by employing delicately constructed ionization apparatus. The earlier investigators — those who believed in the remote possibility of biologic radioactivity — endeavored to demonstrate its presence by photographic methods. That is to say, by placing the hand upon a photographic plate, or by securing the plate to the head or to

the solar plexus, it was believed that the body's radioactivity would impress some kind of markings upon it. And although large numbers of plates and prints have been published and described, it is beyond belief that the markings upon a single one of them are due to radioactive emanations in any form. Undoubtedly they are due to photographic mistakes.

Tousey[2] has pointed out that the perspiration which may be present at the point where the body comes in contact with the plate's wrapper may produce a chemical effect upon the film, resulting in a picture in which the finished print will be seen spotted with white dots. And this is the effect seen upon the majority of those plates thought to have been made by human radioactivity. Rather, as Tousey[2] points out, the markings result from the effects of the body's perspiration on the sulphur contained in the paper which envelops the plate. Experiment shows that the spotted effect, which appears upon plates manipulated for human radioactivity studies, may be entirely eliminated by interposing a blotter between the hand and the plate.

Colson, and later, Russell showed that wood, metals and many other substances would produce effects upon photographic plates; and Russell found that effects could be produced in some cases even with a strip of celluloid interposed between specimen and plate. It was concluded then, and the same conclusion holds for the effect described by Tousey, that those effects were due to the formation of hydrogen peroxide as a result of the superficial oxidation of the substances in moist air.

With a cloud chamber Wilson[3] investigated this subject in 1899. He found that comparatively dense fogs could be obtained with certain metals: amalgamated zinc, for instance. Wilson says:

> There can be little doubt that the effect here described is due to the same cause as the influence which these metals have on a photographic plate, studied by Russell and others. As far as these experiments go they tend to show that the order in which the metals must be arranged to indicate their relative activity in producing nuclei is the same as their order when arranged according to their photographic activity; amalgamated zinc giving the most effect; tin and copper little effect, if any; polished zinc and lead intermediate in activity.

Clark[1, 4] has shown that patterns of butterfly wings can be registered upon photographic plates even though the insect has been dead for many years. It has been found that while the wing patterns may be obtained when cellophane has been interposed between the wings and plate, no photographic effect is demonstrable if glass or quartz is substituted for the cellophane. This fact suggests that the photographic effect is not due to radiations, but to the release of some gas which in turn produces some chemical effect upon the plate. Clark believes "that the pattern effects are due to slow decomposition of the pigments in the wings and the resulting emanation of some gas or gases containing sulphur."

It is my opinion that Clark's provisional conclusion is correct, namely, that the photographic effects are due to some gas containing sulphur. My reasons are based upon the following facts:

1. The radium content of butterflies' wings is so small that no "effect" could possibly be detected with photographic plates; and in no case could the patterns of the wings have been reproduced upon the plates with exposure times ranging from 72 hours to 30 days.

2. Since it has been found that a thin quartz plate does not perceptibly weaken the Gurwitsch rays, it is evident that the emanations from butterflies' wings do not belong in that class; for, as was pointed out above, quartz is totally opaque to those emanations producing Clark's effect.

3. As it is evident that Clark's effect cannot be due to radioactivity, nor to mitogenetic rays, nor to any "vital" radiations (the wings in all cases

were from dead insects) it naturally follows that the effect is most likely due to chemical phenomena. The most logical conclusion is, then, that the emanation is gaseous in nature; that it contains sulphur, which is almost always present in minute quantities in animal and vegetable matter; that hydrogen sulphide (H_2S) is formed when organic matter containing sulphur undergoes decay, which undoubtedly affects the photographic plate in much the same manner as does the human hand.

It may be concluded at once that in no instance cited above were any of the photographic results due to radioactivity. The facts are all against it; the evidence points to (a) errors in technic, and (b) chemical effects produced in a perfectly normal manner. It is evident, therefore, that any proof in support of radioactivity from biologic sources will have to be obtained with delicately constructed ionization instruments.

Study of Types of Ionization

The study of biologic radiations and radioactivity has been conducted with many different types of ionization and other apparatus in our laboratory. Among the instruments constructed by us were the Geiger counter,[5] a drastically modified Townsend apparatus,[6, 7] a very carefully built sphere ionization chamber; several specially built plate condensers; various types of cylindrical condensers; vacuum ionization chambers, one of which will be described here because of its similarity to Evans' apparatus; counters and chambers of various materials, and provided with numerous filtering devices, glass chambers into which many different types of electrodes were introduced, so constructed that they could be exhausted to permit the introduction of gases collected from biologic matter; precision measuring instruments such as electroscopes, electrometers and amplifying equipment; and numerous other devices the descriptions of which would serve no purpose here.

Results which we thought in 1930 were due solely to radioactivity were, in some instances, due partly to radioactivity, but partly also to other emanations which tended to mask the effect. In time, however, the various types of emanations were segregated, studied and placed in their proper categories; instruments were developed which provided greater accuracy and convenience, making it possible to elaborate the several types of biologic emanations of which radon is one.

It is now clear, however, that those radiations found in living matter which are the result of physiologic function are not radioactive in nature; nor are radioactive emanations such as are found in biology the result of physiologic function; the two types of radiations are not related.

For the detection of biologic radioactivity, the apparatus illustrated in the sketch, (fig. 1-A) serves very well. It is much more simple in construction than some of the instruments mentioned above, but very good as a detector, and with the proper calibration[5] radon measurements may be made with considerable accuracy. The apparatus must however be operated at its most sensitive value.

Any fruit, vegetable or minced animal tissue may be stored in a glass vessel, or specimen chamber, S. After four to six weeks the vessel, S, is attached to the system at V — that is, the outlet to the nitrogen tank, N — and the inlet at the bottom of the chamber, S. The outlet of S, at 1, is connected through a pressure gauge, 2, to the glass tube, 3, which contains a generous amount of calcium chloride for removing the moisture from the air. The $CaCl_3$ tube, 3, is attached through a stop-cock, 4, to another larger and longer glass tube, 5. Inside tube, 5, are two long metal plates connected to a battery. Through stop-cock, 6, tube 5 is connected to flask, 7, in which

is a supply of mercury. Flask, 7, connects through valve, 8, to a large brass cylinder, 10. The cylinder, 10, is air-tight and contains a series of six plates mounted 1 mm. apart and very carefully insulated from each other, and from the brass cylinder, with amber. The plates are connected across a source of high potential, 11, which, like the Geiger counter, must be as high as possible; so high, in fact, that it cannot be turned on unless the ionization chamber is full of gas. The ionization system is connected to the electrometer, 15, 16, 17, 18, and 19. (For details regarding calibration of equipment see reference of Hoag's[5] work in this field). The ionization chamber, 10, is provided with a vacuum pump, 12, which connects with the brass cylinder through the valve, 13. A mercury gauge, 9, is provided so that the vacuum in 10, and the pressure coming through the system from the chamber, S, may be constantly checked. The outlets of both the pump and the brass cylinder, 10, (at 14) are carried to the outside.

The specimen chamber, S, is connected into the system, as described above; the ionization chamber, 10, is then evacuated with the pump, 12; the valves and stop-cocks are opened, and the nitrogen from tank, N, is permitted to carry the radon from the chamber, S, through the system into the evacuated chamber, 10. The radon gas is cleared of moisture in the tube, 3, from which it is carried into the "ion trap" at 5. Unless the gas being passed through the system is from the liquid apparatus, to be mentioned later, or from a furnace, as described by Evans,[8] the batteries across the plates are not used. From 5, the gas is washed in the mercury flask, 7, from whence it is drawn into the evacuated chamber, 10. Potential, 11, is then applied; finally a reading is taken with the electrometer, which has been previously calibrated in order to determine the quantity of radium emanation present.

From a series of researches by Evans in 1932, in which he was making a study of liquids and rocks for radioactivity, there evolved a new and very delicate ionization apparatus[9] sufficiently sensitive to measure the radon expelled from patients suffering from radium poisoning, even when less than 100 cc. were available.

Although Evans' apparatus for the study of geologic, marine and biologic radiations[8] is very elaborate and requires an equally elaborate technic, his methods of collecting biologic radon, and the system whereby it is conducted into an evacuated ionization chamber differs not essentially from that part of the system shown in figure 1-A. Evans' ionization apparatus, however, is radically different.

The balanced or double ionization-chamber method employed for these measurements differs basically from earlier differential methods by having the electrometer *permanently* connected to two ionization chambers, whose potentials are such that the electrometer measures only the difference in the ionization in the two chambers. The chambers are identical, both contain N_2 at 1 atmos., but one contains the trace of radon to be measured. The electrometer discharge, therefore, represents the ionization due to radon alone.

The ionization chambers, figure 1-B, are brass cylinders 6 inches in height and diameter, with a $\frac{1}{8}$ inch center electrode. A single, tapered, pressed-amber insulator, waxed into a grounded, brass guard ring, provides the vacuum seal between the two chambers and supports both center electrodes and the stiff lead to the string electrometer. All metal parts are gold plated where they contact the amber, in order to circumvent galvanic currents which can arise when moist amber separates unlike metals, such as two randomly chosen pieces of brass. Radon is always put in the bottom chamber, and P_2O_5 in the drying tray protects the amber from any moisture which might diffuse through the small circular opening in this tray. A thin coat of paraffin in the inside of the brass tray protects it from chemical attack by P_2O_5.

The ends of the ionization chambers are made gas tight by an outside fillet of soft solder, care being taken to avoid the appearance of any solder inside the chamber, because of its possible high radioactive contamination. Immediately before assembling, the inside of the ionization chambers were polished with fine emery cloth,

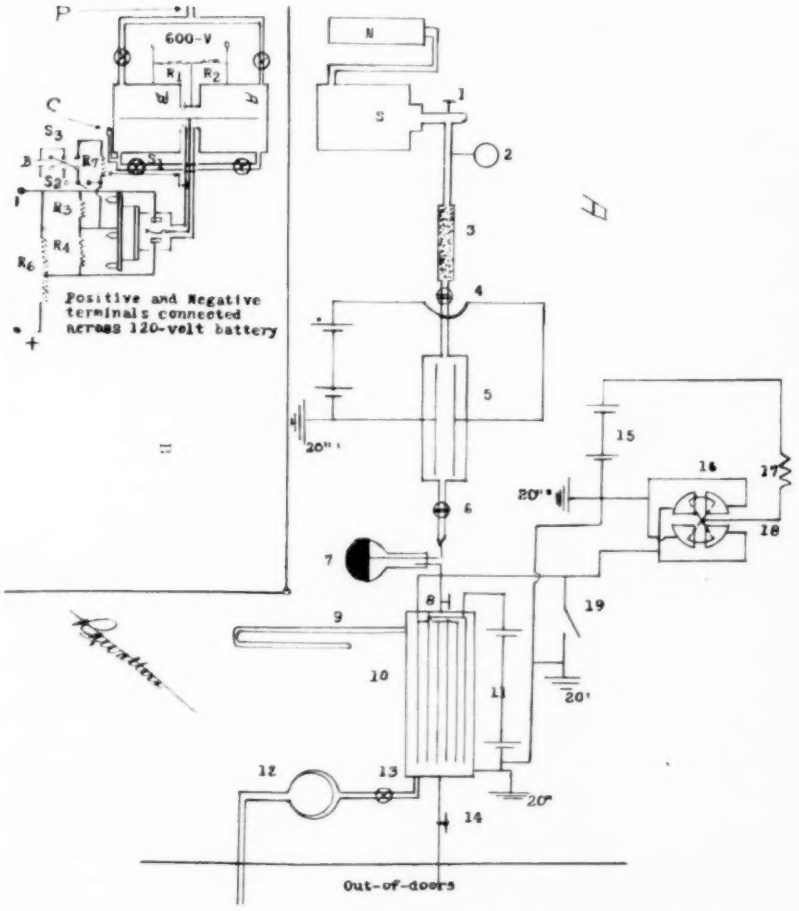

Fig. 1-A. — Diagrammatic sketch of author's ionization apparatus. *N* — Nitrogen tank; *V* — Outlet valve connecting tank — *N* to S; *S* — Glass, airtight specimen container; *1* — Outlet valve from *S* through which radon is carried into system together with nitrogen from tank — *N*; *2* — Pressure gauge; *3* — $CaCl_2$ tube for removing moisture from gas; *4* — Stopcock; *5* — Ion trap; *6* — Stopcock; *7* — Mercury; *8* — Stopcock; *9* — Hg. manometer; *10* — Ionization chamber; *11* — Source of high potential; *12* — Air pump; *13* — Valve; *14* Stopcock in outlet which carries contaminated gas to outside; *15* — Battery to supply potential for electrometer needle; *16* — Quadrants of electrometer; *17* — Resistance to protect needle; *18* — Electrometer needle; *19* — Earthing key; *20* Earth; *P* — Connection for attaching ionization chambers A and B into the system at *8*, figure 1-A.

A, *B*. — Ionization chambers; S_1, S_2, S_3 — Magnetically operated relays.

Fig. 1-B. — Diagramatic drawing of connecting part of author's ionizing instrument; R_1, R_2, R_3, R_4 — Resistances: 105 ohms; String Electrometer, extreme right. (See text for description.)

and subsequent tests showed that their surface retained an unusually low amount of alpha-emitting contamination. The gas inlets and outlets are short lengths of ¼-inch brass tubing threaded and soldered into each ionization chamber near the top and bottom of the side walls. The glass lines are waxed to these with picein.

The charging switch is a vertically moving, platinum-tipped, brass rod which makes contact with a platinum leaf spring in the center of the connection between the ionization chambers and the electrometer. (See S_1, figure 1-B.)

The string-electrometer is a single fiber instrument, with micrometer adjustments on each plate and on the fiber tension. A 60-power microscope, and a tapered brass collar for receiving the grounded shield and connection from the ionization chambers, was built integral with the electrometer. A 32-cp. spiral filament, 6-volt, 3.3-amp. automobile headlamp, behind a ½-inch thick $CuSO_4$ saturated water cell, projects the electrometer fiber and eyepiece scale onto a glass screen and into the slit of a camera.[8]

The arrangement is such that both visual and photographic observations may be made.

Referring again to figure 1-B: P, is the pipe connection to the two ionization chambers, A and B, which was referred to above as "¼-inch brass minus terminals, as indicated, connect the ionization chambers, A and B, across the 600-volt bank of batteries. The symbol "R" indicates the required resistances: R_1, R_2, R_3, R_4, being 10^5 ohms. S_1, S_2, S_3 are automatically opened magnetic relays.

If, then, the apparatus described above, figure 1-B, be substituted for that of figure 1-A, which is designated with numerals from 10 to 19 inclusive, with the exception of the pump, 12, and the valve-pipe system, 13, by connecting the pipe at P (fig. 1-B), to the valve, 8, (fig. 1-A), and the outlet, C, figure 1-B, to valve, 13, figure 1-A, so that pump, 12, can function as in 1-A, a most complete and ideal apparatus is available for the study of biologic radioactivity. (Complete instructions for calibration of equipment will be found in Evans'[8] paper).

When the original sample is a *liquid,* such as the water from radium-activated springs, it is sealed in a flask into which has been fitted a condenser system. The conducting system to the ionization chambers having been evacuated, the flask is placed over a flame, a slow stream of nitrogen is bubbled through the flask into the system, which finally carries the radioactive gas into the ionization chambers, A and B. With the analysis of liquids, as previously mentioned, the "ion trap," 5, is used; the plates are usually charged to 350-400 volts potential. Evans, however, has improved the "trap" by substituting two insulated coaxial brass cylinders, the outer one being 50 cm. long and 2.5 cm. in diameter, with a 1 mm. wide annular space between them through which the gas flows, and between which there is a potential difference of 500 volts. The "ion trap" removes heavy ions; it is very essential when analysis is being made during the boiling of solids.*

In addition to the many hundreds of marine and geologic specimens examined by Evans, he has examined an almost equal total of biologic subjects. With the apparatus herein described, he found that the total amount of radon available in a typical specimen of ordinary matter usually lies between 10^{-17} and 10^{-19}g. This amount differs somewhat from our own calculations, the reasons for which we shall elaborate below:

Sources of Biologic Radioactivity

The question arises, naturally, as to the origin of biologic radioactivity. If due to deposits of radium and radioactive elements implanted within biologic tissues, how did they get there? Radium element, of course, comes from the earth. Aside from the large or small amounts found in pitchblende, it is in all soil; in minute quantities, to be sure, but in measurable quantities nevertheless. Certainly, all vegetables taking their sustenance from the soil would contain a certain amount of radium; and since there are measurable quantities of radon in the air, it is obvious that all plants, vegetables and animals should be radioactive to a greater or less degree. For, if radioactivity be in the soil, it would naturally be absorbed by plants and vegetables with their food; and since radon is emitted by the radioactive elements in the soil only to be inhaled in the air consumed by plants, vegetables and animals, it naturally follows that the radioactivity in Man must come from the food he eats, the water he drinks, the air he breathes, the material things which he handles in everyday life, and the soil with which he is in more or less constant contact.

There are 40 known radioactive elements, and each element has a dif-

* Since Evans' furnace has no place in biologic radioactivity, it will not be described here.

ferent rate of spontaneous disintegration which cannot be altered by any changes of pressure or temperature, or chemical combination. From Nature, Man is constantly acquiring minute quantities of radioactive elements in one form or another: all ordinary materials contain the order of 10^{-12} g Ra per g. In localities like Nevada — especially in the vicinity of Reno — where the rocks and soil abound in readily measureable quantities of radioactive elements (in some localities the presence of radioactive emanation being so great that the leaf-drop on a Bumstead electroscope is 10-20 divisions per minute) it naturally would be supposed that the plants and animals of this locality would be richer in radioactive emanations than those found elsewhere. Upon this premise we base the cause of our discrepancies. Our manner of living, our food, our water and our contacts with Nature preclude results coinciding with those of Evans. Although we have had no opportunity to test our equipment in localities less impregnated with radium than the vicinity of Reno, there is every reason to believe that our results would differ still more with those of Evans, due to the added sensitivity of his apparatus over ours.

Although there appears to be a fair agreement in Evans' results and our own, the difference is much greater than appearances indicate. Knowing that his apparatus is more sensitive than ours, it would in this locality show a greater degree of biologic radioactivity than did our instruments; but because this locality is loaded with radioactive elements to a greater degree than most places, and, undoubtedly, more so than where Evans conducted his researches, our apparatus gives a fair approximation to his results. Where, for instance, Evans shows that biologic matter emits quantities lying between 10^{-17} and 10^{-19} g we show that the emitted quantities lie between 10^{-14} and 10^{-16} g. If, with our apparatus, measurements could be taken coincidentally with Evans' instruments, it is my opinion that the difference would be greater than the above figures indicate.

The water at Steamboat Springs (near Reno), for instance, contains 22 micro-curies per liter (author's calculations 1928); this water is, of course, Radon-water; that is, it contains the short-lived radon gas which is dissolved in water to some degree, and which, if not continually reactivated, loses its radioactivity in a few weeks. Where radon is inhaled, it remains in the blood for only a brief period, probably three to four hours; and where radium water is drunk, the gas is carried to the lungs, where it is exhaled and lost in the air; but where any radioactive element is taken into the body by way of the alimentary canal a small percentage of it remains — that is, from 2 to 40 per cent of any ingested radioactive element may remain in the body, and of that which is eliminated 90 per cent may be in the feces and 10 per cent in the urine. No radium is lost in the perspiration; none is lost in breathing, except when dissipated only in the form of radon. During the time that radon is in the blood, one or two per cent of it decays into the solid radioactive product radium A, some of which is permanently deposited in the system where it continues to decay, that is, it emits 4 alpha and 4 beta particles per original atom of radon, after which it becomes lead.

Since it has been shown by Crile[10] that ionization resulting from ultraviolet radiations in biologic tissues is vital to the life processes, the question naturally arises as to the part played by the ionization resulting from radioactivity in the tissues; for it is now evident that within the body tissues, the bony tissues and the blood there must be constantly going on an ionization due to radioactivity. Ingested radioactive elements, body constituents, such as potassium, rubidium, inhaled radon, and the like, all must contribute toward ionization in every cell throughout the body, which ionization may be most necessary to life; just as necessary, perhaps, as any other element

or radiation. The ionization resulting from radioactive elements may be as important as any other biologic radiation, however important that may be; since the alpha particle, for instance, in passing through the tissues, ionizes about 100,000 atoms before it is brought to rest. Just as ultraviolet radiation from the sun is necessary to biologic life, so, too, may the cosmic rays, and biologic radioactivity play an important part.

Since as little as 2 micrograms of radium may prove fatal to human life, it is obvious that the radium content of the body would have to be far below that amount; and since as much as 2 micrograms of radium scattered throughout the tissues of the human body could not possibly produce a single impression upon a photographic plate, even if exposed over long periods of time and under conditions more ideal than those under which the majority of plates have been exposed, it is evident that such markings as have been found upon plates exposed to the human body resulted from causes other than radioactivity. The conclusions of Russell, Wilson, and Tousey, Clark and others are undoubtedly correct: the "effects" are due to chemical phenomena.

That biologic radioactivity exists has been proved beyond doubt. These radiations are totally different from the chemical emanations described above in that they are alpha and beta in character,[1] resulting, as has been said, from the decay of radon -- either inhaled, or emitted from decaying ingested radioactive elements — which result in the emission of 4 alpha and 4 beta particles per original atom of radon until eventually, the product becomes lead.

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IMPROVED BOOT AND CUFF FOR SUCTION-PRESSURE APPARATUS *†

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Several types of equipment for applying alternating negative and positive pressure are now available for the treatment of occlusive arterial disease of the extremities. During the past three years we have used four different makes of apparatus, built according to the principles set down by E. M. Landis, in the routine treatment of patients. In all four, the least satisfactory part of the equipment has been the flexible cuff by means of which the air chamber or boot is fixed to the extremity.

A number of factors contribute to the difficulty of producing a cuff which is at once efficient, durable and comfortable. It must grip the skin of the upper arm or of thighs of differing size sufficiently to prevent leakage of air during wide fluctuations of pressure. Yet the cuff must not constrict the tissues or cause venous congestion in the limb. It must in addition be so constructed as to be easily and quickly applied and to withstand hard use. Finally, it is of obvious advantage for the attendant to be able to apply the boot with minimal manipulation of the part, especially when multiple daily treatments are necessary for an intensely painful extremity.

The boot and cuff to be described have been evolved out of several attempts to fulfill these requirements. We believe that the apparatus is an improvement over that now available. It has been given thorough trial in the treatment of various types of patient.

The wide, thick cuffs of soft sponge rubber are made with openings of three diameters to accommodate different sized limbs. They allow close application to the skin without bandlike constriction, since the thick mass of rubber is compressed about the tissues evenly as the straps are fastened and the aluminum frame is applied. Instead of being inserted from the end through the opening in the cuff, the limb is simply lifted and laid in the open cuff and boot. The upper half of the air chamber is then clamped tightly to the lower, and the adjustable support at the distal end of the boot adjusted for comfort or to allow gravity to aid in the emptying of vessels during the positive pressure phase.

Description

Figure 1 is a general view of the boot. It is constructed of thin aluminum sheeting with celluloid windows in the upper half, the whole being reinforced with a steel frame. The proximal end is cylindrical in section, 23 cm. in diameter for a length of 18 cm. to receive the sponge rubber cuff which makes the closure with the patient's limb. From this cylindrical section the boot expands to an elliptical section whose major and minor diameters are 35 and 23 cm., respectively. The length of the tapered section of the boot is approximately 70 cm., making an over-all length of 88 cm. The boot is separable along a horizontal plane at approximately its mid-point. The two halves are clamped together by 8 screws "C." The joint is made air-tight by the rubber gasket "G," which is made from fairly dense sponge

* From the Vascular Section of the Robinette Foundation and the Eldridge R. Johnson Foundation for Medical Physics, University of Pennsylvania, Philadelphia.
† Aided by a grant from the Council on Physical Therapy of the American Medical Association.

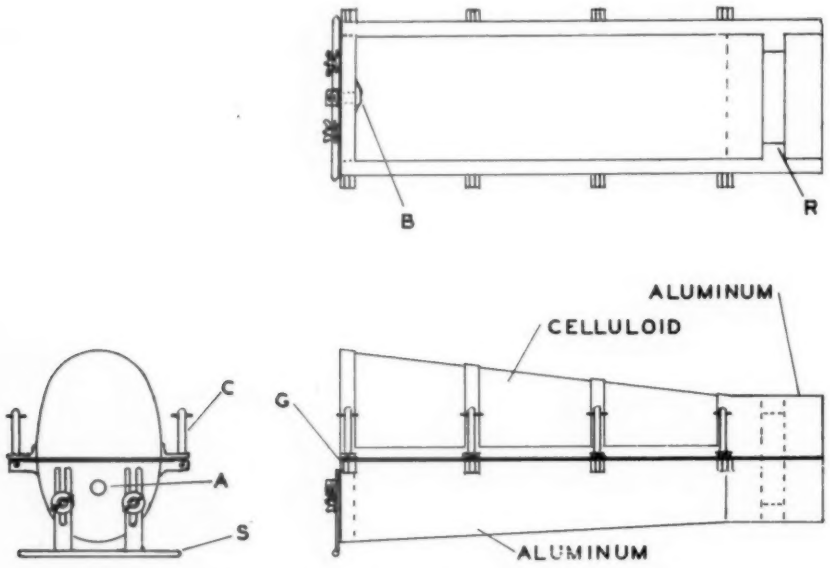

Fig. 1. — General view of the boot. For description see text.

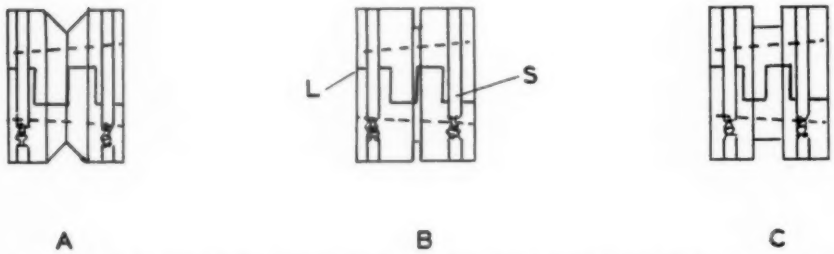

Fig. 2. — Outline of experimental rubber cuffs. A. First and unsatisfactory model. B. Satisfactory model but presenting difficulty at gasket. C. Final and adopted cuff.

rubber No. 6 grade, 6.5 mm. thick. The boot is held in a comfortable position on the bed by the adjustable stand "S." Connection to the pump is made at "A." The baffle "B" inside the boot prevents the stream of air from striking the patient's foot. The upper view in figure 1 shows the bottom half of the boot only. The rubber cuff is retained in position by the ring "R" which is sealed air-tight to the cylindrical shell of the cuff.

Figure 2 shows the outline of three types of rubber cuff which have been tried. All the cuffs were made by cementing layers of soft sponge rubber together. We have found that 90 below is a satisfactory density. It is necessary to cut the rind from the surface of the rubber sheets adjacent to the central hole before cementing them together in order to prevent discomfort from the added stiffness. The central hole is tapered approximately 2 cm. in diameter over the length of 18 cm. It is necessary to have a series of perhaps three cuffs with different size central holes to fit different patients. The cuff is split along a zig-zag line "L" so that it may be easily placed around the extremity and yet not leak along the juncture. The joint is held together by two straps "S" which are made of rubberized canvas with hook fasteners. These straps are cemented to the cuff through about three-quarters of its circumference.

Sketch A in figure 2 shows the first form of cuff experimented with. This cuff sealed perfectly, but the wedging action obtained as the soft rubber

was drawn over the triangle mid-point ring during suction caused discomfort. The cuff shown in sketch B had less wedging action and was quite comfortable. There was difficulty, however, with the gasket at the joint of the narrow retaining ring required for this type of cuff. The final cuff adopted, shown in sketch C, is comfortable and seals adequately. The wide retaining ring at mid-circumference permits a satisfactory seal with the gasket of the boot proper.

SPA TREATMENT OF CHRONIC HEART DISEASES AND THEIR COMPLICATIONS *

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It is a well known fact that chronic cardio-vascular disturbances are persistently increasing in number. It is likewise unquestionably true that the number of cardiac invalids is alarmingly large. Yet, so far few attempts have been made to restore the working capacity of the victims of cardiac diseases or improve their condition. In this field especially physiotherapy is still largely neglected. Physiotherapeutic methods may be used extensively in cardio-vascular disturbances. Hardly any of these methods, if suitably and individually applied in these conditions, will fail to bring relief. On the other hand, only a few of these physiotherapeutic methods are effective when applied while the patient continues at work. Among these exceptions are radiant heat applications to the thorax, short wave therapy, pneumatic massage and diathermy, especially in peripheral vascular disturbances. The physiotherapeutic treatment of a patient is usually effective only when he interrupts his professional work and adjusts his entire mode of life to cardiac preservation.

In acute cardiac disturbances, or in more serious symptoms of insufficiency in chronic heart diseases, in other words, at the sudden onset of incapacity for work, the patient is usually willing to submit to the physician's orders. The treatment can then be given in the city at the patient's home or at the hospital. However, the semi-invalid cardiac patient, who is still capable of doing some work is but seldom willing to take such a treatment steadily. A really suitable treatment in chronic vascular disturbances can usually be given only at a spa.

Thus spa treatment of a cardiac patient does not imply merely treating him with baths of a certain kind. It consists much more in a suitable combination of physiotherapy, climatotherapy, psychotherapy, dietetics and regulation of his entire mode of life. On the basis of these considerations the State of New York appropriated a considerable sum of money for the purpose of developing Saratoga Springs, the well known health resort, into a modern spa for cardiac patients.

Balneotherapy, particularly carbonic-acid baths, ranks first among modern physiotherapeutic means especially indicated for chronic heart diseases. In comparison the treatment with internal mineral waters is negligible. Depending on the patient's condition, even electrotherapy is suitable: for instance, faradization or a quadruple-cell electric bath. Ultraviolet irradiation and short wave therapy are the two methods used. Mechanotherapy with its specially

* Read before the New York Physical Therapy Society, New York City, April 1, 1936.

constructed appliances is used principally as passive gymnastics. It can obviously be given even by hand, provided that well trained masseurs are available. Massage, which is one of the most important adjuvants is naturally applied only as a very mild treatment to stimulate the circulation. In addition, there are many less important therapeutic measures.

All physiotherapeutic methods for the treatment of vascular disturbances have the same purpose: To make possible better and more economic cardiac action by lightening the work of the heart and reducing adventitious obstacles. It is, therefore, requisite that the treatment restore to normal values the pulse which is too slow or too fast, and the blood pressure which is too low or too high; expand, deepen, and calm respiration; improve the minute volume of the heart; increase urinary excretion. Only this relief renders individual physiotherapeutic measures possible to train the heart.

Checking up on pulse blood pressure, and respiration, observing the minute volume and so forth enable us to control the effect of the individual methods. Roentgen and blood examinations, urinalysis, electrocardiograms and stethograms, examination of the lungs, the liver and the like, repeatedly made before, during, and after the treatment, demonstrate either objectively or graphically the results obtained. I shall avoid any discussion of the many experiences and the results of experimental research which have already been published. The best living tribute to the success of physiotherapy in cardio-vascular disturbances is undoubtedly the thousands upon thousands of patients who obtained improvement if not recovery, through balneotherapy.

Correlation of Therapy

The importance of climatotherapy in the treatment of cardiac patients is still underestimated and altogether neglected. The influence of climate and its separate factors on the circulation has received hardly any study. It is true that the importance of medical climatology is just beginning to be appreciated. Health resorts offer the best opportunity for studying the effect of these important problems on our patients.

Even the dietary treatment of cardiac patients is not yet sufficiently appreciated. A salt-free and protein-free diet, which is immediately prescribed as a routine measure, is not necessary or advantageous for all patients. In many vascular disturbances the distribution and number of meals, the digestibility of the food, its high residue, and many other factors are more important. The same is true of beverages. Alcohol is not generally harmful, often it is indeed a medicine. Even coffee is not contraindicated in some disturbances, but favorable when taken in the proper way and in reasonable amounts. On the other hand, restriction of the fluid intake is almost always very important. Even tobacco does not injure every patient, and in moderate quantities it is occasionally a nerve tonic. Obviously I cannot go into details but can only point out the importance of individualization.

The same must be said for regulating everything else. The daily program of the patient during treatment is of the greatest importance. It must be carefully adjusted to his illness and personality, and frequently changed. The careful fixing of periods of physical and even of mental rest and of their duration, the proper selection and dosage of physical exercise, the alternation of repose and activity are among the curative factors of the treatment. The program must be very carefully selected also from the psychotherapeutic point of view. In this respect apparently unimportant problems must be talked over with the patient, such as the length of conversational periods, or the permission to play cards, or similar topics. On the other hand, proper amusement, musical entertainment and other diversions must be provided, in order to enable the patient to forget his illness. The treatment is not merely a period of temporary relaxa-

tion for the cardiac patient, for whom the pace of city life, business and society, or family inconsiderateness have been too much; or a few weeks of relief from motor noises, exhaust gases, unnecessary telephone calls, radio loud-speakers, and other noise makers in his own or his neighbor's home. The treatment is also a period of training the patient: (1) in adjusting himself to his disease; (2) in showing him the mode and extent of properly meeting his business obligations in spite of his restricted cardiac action; (3) in teaching him the mode of life most suited to him and his condition.

Finally, it is much to be regretted if the physician gives up pharmacotherapy altogether at the spa in order to convince his patient of the efficiency of physiotherapy. Medication prescribed steadily or periodically for cardio-vascular diseases is the most important preventive treatment. The course of treatment often gives the best chance for the individual study of the efficiency of the many cardiac remedies and the determination of the best dosage for continued administration.

Complications

But even though the patient comes to the spa for cardiac treatment we must not neglect the other organs, because most chronic cardiac patients also present secondary organic or functional disturbances. Almost every cardiac patient has a "second" disease. In quite a large number of patients cardiac disease is due to another disease. Obviously the physician must know all these diseases — whether they be primary or secondary — so that he may take them into account when prescribing the treatment, which must be planned accordingly in order to avoid failure. Moreover, the physician must not rely on reports but must personally find out the condition of every organ. This is the only method by which he controls the therapeutic result. Finally, it is our duty to give the patient every opportunity, during his sojourn at the spa, to derive the greatest possible organic repair. However, this again requires that the different modern physiotherapeutic methods of the spa be available.

I shall limit myself to the most important of these complications. At the same time I shall briefly indicate the extent to which "this second disease" changes the rules of the treatment, and what physical remedies may possibly be applied to this "other disease."

The most frequent primary disease associated with chronic cardio-vascular disturbances is infective rheumatism, the most common cause of valvular diseases, which not infrequently leaves chronic rheumatic changes. While we obviously prescribe only mildly saline baths for the cardiac patient, we try to influence his rheumatic component simultaneously by adding saline or motherlye, and the like. We administer in addition diathermy, local electrical light baths, and slightly stronger local massage. Mud packs, local paraffine applications and the like are very effective. Other types of rheumatism, neuralgia, arthritis require similar treatment with the addition of proper gymnastics.

Among the disturbances of metabolism, gout more often causes diseases of the heart than is commonly assumed. The treatment resembles that of rheumatism. The careful drinking of alkaline waters is indicated. Yet large quantities must be avoided and the water must be distributed throughout the entire day. The diet must naturally be changed accordingly.

Obesity injures the heart only in very rare cases in the form of direct myocardial changes. We usually have before us constitutionally weak hearts which deteriorate still more under the excess body-weight. These patients usually have very slight anginal attacks. Baths richer in salt may be prescribed only when the cardiac force is sufficiently great. In anginal disorders all baths must be given as half-baths and massage, if any, must be very carefully dosed. Laxative mineral waters may be profitably administered, but in small quantities.

It is generally sufficient to prescribe for almost every patient one glass of water in the morning before breakfast, provided mineral oil with agar is taken at night. Naturally we must inquire whether adiposity is due to endocrine dysfunction. These very numerous cases require prompt organotherapy.

The endocrine component must not be overlooked even in many cardiac patients whose disease starts at or shortly before the onset of the climacteric. On closer inquiry many patients with high blood pressure are found to have marked flushes even after the age of 60 years. Endocrine treatment with ovarian medication is often effective by itself, even though only temporarily. These women with high blood pressure must receive the following treatment: half baths without salt; reduction of fluid intake; salt-free diet. In vascular disturbance or myocardial weakness the temperature of the bath must be carefully adjusted to individual sensitivity. Very brief baths at frequent intervals must be given.

Basedow's disease and all kinds of thyroid dysfunction are known to cause various vascular disturbances, ranging from simple vasomotor changes to the most severe myocardial degeneration. The prescriptions must be changed correspondingly. Severe muscular diseases of the heart require baths of neutral temperature. Half baths and short time for bathing are indicated. In severe thyrotoxicosis with high blood pressure, half baths must be given unconditionally. The temperature must be lowered only gradually. By contrast, genuine Basedow patients tolerate remarkably low temperatures and as a rule ask for them. It is impossible to review all the varieties of this group and their different methods of treatment.

Among pulmonary diseases, nervous bronchial asthma and secondary as well as primary emphysema are especially provocative of cardiac disturbances. In time even chronic bronchitis often damages the heart. In all these conditions hydrotherapy must be combined with medicated or pneumatic inhalation. Mechanical gymnastics, or manual respiratory gymnastics are very effective, yet require medical supervision, particularly in secondary vascular disturbances, Drinking of alkaline water or gargling with it in the morning is occasionally helpful.

"Second" Disease

In briefly outlining the most important so-called second diseases of cardiac patients, it is pointed out that some of these are often at the same time the primary trouble. In the first place chronic tonsillitis must be mentioned. Even when cardiac disease is not directly connected with tonsillitis or a retrotonsillar abscess, every infection obviously constitutes a double strain for a weakened heart. There is often better opportunity at the spa than at home for discovering such latent conditions by repeated examinations of the blood and throat and for prescribing proper treatment. The latter is not necessarily always surgical, for conservative therapy, which must be started while the patient is at the spa, is frequently effective.

The same is true of infective dental abscesses. Many patients with chronic rheumatic heart disease neglect dental hygiene for the simple reason that they are physically unable to stand a visit to the dentist. These patients are frequently cured by short wave therapy. However, dental extractions must be done when needed.

On the other hand, I think that the effect of diseases of the accessory nasal sinuses on the heart is overestimated. Obviously, the patient should have diseases of the accessory nasal sinuses treated while he is at the spa. Some of these patients benefit from inhalations as well as from the very effective short wave therapy.

The frequent ocular disturbances due to arteriosclerosis, particularly in

high blood pressure, require during the treatment repeated—not only a single —examinations of the fundus. In cases of mild hemorrhage the greatest care must be observed in every treatment. When the patient presents scars of previous hemorrhages, or when bleeding is suspected, he must take only half baths and apply a cold compress to the head while bathing.

Even aural disturbances must be taken into account. Many patients with sclerosis who complain of vertigo present unilateral hardness of hearing, and in a still larger number of them the tympanic membrane is plugged by cerumen. These patients must be carefully treated with half baths of a low saline content and short duration. Moreover, pneumatic massage of the ear can be recommended.

The second disease most frequently involves the abdomen. Many of these cases have been wrongly diagnosed for years. Either cardiac disease has been assumed while the apparently anginal attacks are caused by abdominal colic, or else gallstone colic has been assumed while the patient suffered from angina pectoris. Untold numbers of patients suffer from both diseases, either one of which complicates the other.

During spa treatment chronic cholecystitis and calculi of the gallbladder are often very troublesome because of constant or periodic pains. Some of these patients must interrupt their course of treatment. These undesirable interruptions can easily be avoided by telling the patient to wear a damp abdominal compress after the bath, and by prescribing mud packs on the off-days when he does not bathe. The internal administration of mineral waters is, of course, indicated for these patients. But the "trinkkur" must not be overdone; a low fluid intake is sufficient and its rapid excretion must be provided for.

Almost the same may be said of renal calculi. Concerning the use of mineral waters in renal concretions, I do not recommend the daily drinking of the waters. If the cardiac condition permits it at all, I prescribe once or twice a week the slow ingestion of 400-800 cc. of water during 1 or 2 hours on an empty stomach. This produces a larger pressure effect and quicker excretion.

Finally numerous cases of intestinal diverticulitis present similar symptoms. These patients often react to hydrotherapy with attacks suggestive of appendicitis. Thus we must be informed of the presence of diverticulosis. The attacks can again be avoided by prescribing damp, warm abdominal packs after every bath. Laxative waters must be given in careful doses, to prevent marked irritation. Dietary rules for the groups just mentioned are self-evident.

Let me omit the large number or rarer complications and discuss only two especially important groups. The first includes patients with prostatic hypertrophy. The baths have an unusually strong effect on the prostate. Very frequently a few baths cause tenesmus with retention of urine, which interrupts the treatment or greatly disturbs it. Precautions to be taken here consist in prescribing half-baths and, particularly, the use of a belladonna suppository after every bath. The treatment has a curative effect once the first baths have been tolerated. Many a prostatic enlargement completely subsides after a course of treatment. Obviously, these patients are given mild laxative treatments, possibly laxative waters, to relieve pressure on the prostate.

The second group includes various types of pelvic disturbances. Damp and warm packs are indicated here, in order to avoid undesirable irritation. When the general health permits, mud baths or mud packs are given on the off-days of bathing. The carbonic-acid content must be greatly reduced when the patient shows a tendency toward bleeding. On the other hand in amenorrhea it must be increased to the maximum, and possibly genuine gas-baths

must be given. Concerning massage the greatest care is advised in all abdominal complications.

Finally, we must consider the diseases of other organs presumably caused by vascular disturbance. Disturbed menstruation, especially observed in mitral stenosis, must be most carefully taken into account when prescribing baths. Cirrhosis of the liver in chronic valvular insufficiency is frequently the reason why patients cannot stand the course of treatment. The damp, warm, abdominal pack may often relieve less advanced cases. Treatment by internal use of mineral waters is entirely contraindicated. It is better to prescribe for these patients highly concentrated saline aperients in a little water. Secondary gastro-intestinal catarrh—catarrh due to passive congestion—likewise cannot be treated by mineral waters. The diet must be adapted correspondingly. Effective treatment eliminates the catarrh.

In congestive heart disease the patient, as well as the physician, pays too little attention to hemorrhoids, which cause secondary constipation with subsequent inflammation. The first baths often induce a salutary reaction, on account of which the patient consults the physician, who starts proper treatment. Depending upon the condition of the heart, mild treatment by internal use of mineral waters may, of course, be attempted.

Special attention must be given in cardiac patients to their tendency toward phlebitis. To avoid irritation from hydrotherapy, astringent poultices must be applied to the legs after the bath, or can be added to the bath. Of course, massage must be most carefully given and the threatened veins be left strictly alone.

Bronchitis due to passive congestion spontaneously improves under the favorable effect of the treatment. However, mild inhalations are beneficial.

Diabetes in patients with sclerosis often subsides during the course of treatment, even with a more generous dietary regimen. However, even this disease may often exhibit an increase, particularly in blood sugar, during the first few days. Close observation and early insulin treatment are, therefore, essential.

Primary diseases of the kidney must be excluded from bath treatment until they are completely cured. Sclerotic patients with secondary diseases of the kidney not presenting pre-uremic symptoms, may be admitted with corresponding precautions. For these patients half-baths are obligatory, at a temperature never lower than 95 degrees F. Treatment by internal use of mineral waters is entirely contraindicated.

The most careful treatment is required in patients with a tendency toward embolism. These patients must be given only half-baths at a neutral temperature and of short duration. They require complete repose during the course of treatment. Consequently no other therapeutic methods must be applied, since they are too strenuous. Hydrotherapy must begin not earlier than six months after embolism. Sequels to cerebral embolism and other lesions of the nervous system naturally do not always benefit from bath cures. Yet much may be done by simultaneous electrotherapy, gymnastics and exercise.

This brief survey shows the many variations required in cardiac therapy, if failure is to be avoided. It shows the need of cooperation by various specialists in the course of this treatment. Moreover, it shows the many types of therapeutic methods and remedies which must be available when prescribing an effective spa-treatment individually adapted to each patient. This survey finally demonstrates the requirements that must be met by a health resort which specializes in cardiac therapy.

On this point I shall limit myself to a brief account. In addition to the various physical, natural, and artificial remedies and therapeutic methods, there must be available all the modern appliances and methods of examination, as

well as experienced specialists who are willing to coöperate. Physicians at the spa must be afforded opportunities for observing and studying, with the assistance and under the direction of theorists, the effect of physical remedies on their patients, as well as in animal experimentation. The spa must offer the patient a restful sojourn in modern hotels with high and well ventilated rooms and suited to life at the spa. The hotels must be constructed so that guests do not annoy one another. Balconies must be provided, so that patients can lie down outdoors even in poor weather. There must be a large quiet park, where automobiles are not allowed, and shady paths offering opportunities for walks. This park must have sufficient benches where the patients can sit down and rest every 5 minutes. Trained nurses must be available at the hotels day and night. All medical institutions must be under the supervision of physicians. The employees of the bath houses and elsewhere must be well trained, experienced in dealing with cardiac patients, and courteous. In the confines of the spa all noise and nervous excitement must be avoided, but mild entertainment and artistic performance should be provided.

This briefly reviews what I have often and more fully planned for Saratoga Springs, by invitation of the State Committee. Even Rome was not built in a day. Dr. McClellan's statement will show you presently that much of the Commission's program has already been carried out, and that many of its aims have been realized.

Discussion

Dr. Hans J. Behrend (New York). Dr. Groedel has covered the subject so thoroughly that any further discussion would mean a repetition of what has just been said. I have been several times in Saratoga Springs and found there a happy union of the three factors so important for the success of a great spa, namely, the combination of valuable natural mineral waters and mineral baths in a pleasant environment with possibilities for rest and relaxation and with educational factors for the patient and his physician. Dr. Groedel has just outlined the modifications of spa treatments which very frequently become necessary because of certain combinations of the cardiac diseases. Diseases of the heart and the circulation are an excellent example as to the necessity of not using a routine schedule of treatments, and what is allowed to the cardiac cases also extends to the treatment of, for instance, rheumatic or gastrointestinal disorders.

May I say a few words with regard to the educational factor. During his stay in the spa the patient should be taught the way he ought to live during the rest of the year. He should learn which dietary laws he has to observe and which simple hydrotherapeutic applications he could use at home to keep up the recovery obtained after a course of treatments. And the physician who visits the spa should get acquainted with the methods used there so that he can guide his patient after his return home. Saratoga Springs, as I said before, fulfills all the demands. The recently built research laboratories will give physicians the opportunity to study balneology on the spot, and the new recreation center will give the patient many suggestions how he can get a good training in spite of his ailment. The state of New York has a right to be proud of the development this spa has undergone during the last years. We owe our deepest thanks and appreciation to Dr. Groedel for his fine paper and to Dr. McClellan for coming to New York and telling us about his interesting work in Saratoga Springs. It is my honest opinion that Saratoga Springs is ready to go into competition with the best European spas.

(*Continued from page 748*)

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MASSAGE IN MANAGEMENT OF FRACTURES *

MAX A. LEVINE, M.D.

LOS ANGELES

Massage in the treatment of physical ailments dates back at least to the time of Hwang Ti[1] (2697 B. C.). The account of its application is not very clear as regards indications, only its simple forms of tapping, kneading, pinching, chafing and pommeling the body being described. It was not until the time of Lucas-Championnière,[2] however, that massage was stressed as an important adjunct to the treatment of fractures. Prior to his time fractures were treated by prolonged immobilization with resultant unsatisfactory restoration. To render his contemporaries conscious of the marked disabilities following immobilization, Championnière swung the pendulum to the opposite direction by encouraging very early mobilization and massage. His principles were gradually modified by his followers, so that at the present time the ideal combination in the treatment of fractures is anatomic reduction, adequate fixation, early mobilization and massage.

To appreciate the part played by massage in the management of fractures it may be apropos briefly to review the patho-physiology of the average simple fracture. The probable sequence of events following fracture, as based on extensive scientific studies in bone healing has recently been summarized by Murray.[3] Following the initial trauma there is tissue necrosis and inflammatory reaction. This reaction in addition to the autolysis of tissue secondary to necrosis increases the acidity of the local tissue fluid, which in turn decalcifies the dead bone at the site of the fracture. The calcium is bound in situ by its affinity for the fibrin liberated by the hemorrhage of the primary injury. The reparative process which is to utilize the trapped calcium in the healing of the fracture, starts with the proliferation of granulation tissue. The well known vascularity of granulation tissue allows for rapid absorption of the products of necrosis. This in turn lowers tissue acidity, changes local phosphorus concentration and facilitates the utilization of the calcium that has been held in place.

Thus any retardation of circulation, such as by stasis from any cause, will delay the healing process, and conversely it may be expected that any procedure that reasonably improves local circulation will hasten healing. It is for these reasons and precisely at this stage of the healing of fractures that massage becomes a useful therapeutic adjunct. What we might term the pharmacodynamics of massage have been studied both in normal and diseased fractured tissues. Krogh, Carrier and others (quoted by Pemberton[4] and coworkers) have shown that even light massage produces marked vasodilatation. This can be prolonged by deeper massage, which is true also of the other forms, such as compression and percussion. This action will be beneficial in accordance with the principles previously outlined. Not only does vasodilatation favor the absorption of the products of autolysis and then hasten healing, but the local improvement in circulation also lessens edema and then relieves pain.[5, 6] Reduction of edema, lessening of pain and cessation of muscle spasm are three additional properties of massage. Part of the relief of pain and spasm is probably on a reflex basis by relaxation, as indicated by the better subjective results obtained by application of massage in one direction, either centripetal or centrifugal. Massage is mostly dependent

* Read at the Fourth Western Sectional Meeting of the American Congress of Physical Therapy, Los Angeles, June 18, 1936.

on local physical effects, chiefly vasodilatation. No constant effects on any significant humoral factor as CHO_3[3] saturates of blood phosphorus, have been observed as emphasized by Pemberton.[4]

Scope and Indications

Having reviewed somewhat the rationale of massage as a therapeutic agent, we may turn to a brief discussion of the salient features of its clinical applicability illustrated by some specific instances. The first question that arises is when can massage actually be instituted? From a theoretical consideration we have seen that it has a place only when the reparative process has begun. This must be determined by clinical and roentgenologic means and will vary somewhat according to the site and nature of the fracture. The other and governing consideration as to time of use of massage is determined by the nature of the injury. It is obvious that while with a soft tissue injury massage could be undertaken fairly early, in fractures such a procedure is applicable only with assurance of the stability of the fracture site.

Having been assured on these points, and in the absence of any obvious contraindications (local infection, general or local vascular disease with the associated danger of initiating pulmonary embolism) we next inquire as to the proper method of massage. The answer presupposes consideration of the various types of massage. The simplest and most practical classification is based on the various component movements that make up massage.[7, 8] The first type is stroking or *effleurage*. Stroking or effleurage may be either superficial or deep. The superficial is done centrifugally for purely reflex effect in allaying pain and spasm. The deep is more forceful and performed centripetally, mechanically influencing the capillary beds and thereby aiding the venous and lymphatic return flow. The second type is compression, which may be in the form of kneading, i.e., compression of a superficial against a deep layer, or friction which consists of a very localized pressure with finger tips, or *petrissage* which means picking up and squeezing the tissues, particularly the skin and subjacent layers. The third method is percussion or *tapotement*, which consists of the various methods of "beating" the tissues. Its action is first reflex constriction of the subcutaneous blood vessels, and because of this tonic effect is useful between and after active exercises. A paralytic vasodilatation occurs if percussion is unduly prolonged. This type of movement is contraindicated over the fracture. In any of these forms of massage the guiding principle is not to cause any harm.

The type and amount of massage given depends on the type of fracture, whether or not there is impaction of the fragments, displacement before and after reduction, and proximity to the joints. In simple fractures with no displacement, such as fissures, cortical sprains, greenstick and buckling type, and with the periosteum intact, massage can be started early. In impacted or interlocked fractures massage is started later and approximately two or three weeks earlier than in the presence of some displacement. When dealing with fractures into joints, it is of utmost importance first to obtain as perfect a reduction as possible, especially that the articular surfaces should be even, motion and massage becoming important adjuncts after adequate repair.

Technics

With these general considerations of massage, from the standpoint of its scope, indications, and conditions, we may take up the various specific instances and manner of its application. The extremity involved in a fracture is a unit which may be divided into three segments (after Goliakhow-

sky), superior, middle, and inferior; that above the fracture is superior, that below is inferior and the fracture site corresponds to the middle segment.[9] After the fracture has been immobilized for a certain length of time depending upon those conditions described above, the limb is carefully taken from the cast or apparatus and replaced in the same way. Lubricants, such as olive oil, liquid petrolatum, should be used in order to prevent chafing of the skin, or dragging of the hair. During the first sessions only superficial rubbing is executed gently and without effort over the superior and inferior segments. The middle segment or fracture site is left untouched as it may displace the fragments or incite marked proliferation of callus, which might prove injurious if close to an articulation. During subsequent sessions, gradually the fractured site is massaged more frequently and longer, pressure, percussion, and kneading of the muscle mass being carried out in addition to stroking. This prevents muscle atrophy. Passive and active motions of the distal articulations should not be lost sight of during these seances. Finally, not until the fracture is almost completely consolidated are the joints adjacent to the fracture site moved passively. As soon as the fracture is completely healed, the cast or splint is removed and movements of reeducation are initiated.

I should next like to illustrate the application of massage by discussing its use in specific types of fractures. In fracture of the clavicle the deltoid is massaged with gentle pressure, then the trapezius from above downwards to the clavicular region, using effleurage and digital pressure. Usually at the end of ten to fourteen days, deep rubbing, kneading and manual vibration are begun. During this interval the joints distal to the shoulder are moved actively as well as passively and when union of the fracture is established, motions of the shoulder are instituted.

In fracture of the scapula active massage or kneading is begun later on account of the ease with which displacement is apt to take place.

In fracture of the humerus, the deltoid is massaged in the form of rubbing and pressure; likewise the supraspinatus, pectoral and trapezius muscle groups are massaged.

In fractures about the elbow and forearm besides the usual types of massage, active and passive motion is important.

Fractures of the inferior extremity of the radius involve the additional necessity of massaging the hand and arm, utilizing rubbing, pressure, kneading, vibrations and later percussion of the fleshy upper portions. Digital pressure is exerted on the tendon sheaths and interosseus muscles. Each session is terminated by a general massage of the hand and forearm, and if immobilization has been somewhat prolonged the arm also is massaged.

With fracture of the bones of the hand, it is of great importance to massage the muscles of the forearm and tendon sheaths as well as to exert adequate rectilinear pressure, from above and below.

In fracture of the fibula, the leg is so placed that the antero-external surface faces anterior, then the perioneal and extensor groups are massaged. This is completed by massaging the entire foot. Here the joints may be mobilized early.

In fractures of the femur, if the extremity is in Russell traction, massage may be begun with early, and if in a cast this therapy is not carried out until the bone is consolidated. The middle segment is not massaged until after a few sessions. When the patient is able to turn, the buttocks are massaged with deep pressure, kneading, patting and percussion. The patient is then turned on his back and the quadriceps, sartorius and the adductors are massaged, but the flexors of the thigh and calf are not massaged until there is sufficient callus to prevent anterior bowing of the femur, which so commonly

follows hyperactive flexors. Also, the distal articulations are again moved passively and actively.

In fracture of the tibia massage must be guarded during the preconsolidation stage. In view of the lack of muscular tissue anteromedian contractions of the posterior and anterolateral muscle groups will produce a medial bowing of the tibia, which is to be avoided. Movements of the hips and toes should precede massage. Equinus deformities in this connection should be avoided. The same rules apply to the inferior extremity of the leg, as stated above. Fractures of the metatarsals are managed in the same manner as the metacarpals.

The physical therapist should remember that massage is contraindicated in certain conditions. Foremost among these are recent inflammatory conditions and suppurations. Massage and passive movements are apt to reawaken this inflammation and when sinuses are present lymphangitis and cellulitis may be excited. In acute traumatic bone atrophy (Sudeck's disease) massage may not only accentuate the condition, but also produce considerable pain. Massage is also not without dangers. As previously mentioned too early massage may displace the fragments, produce also a hyperostosis, and it is believed by some surgeons, most prominently Frankel, that massage in recent fractures may bring on pulmonary embolism. It is chiefly because of these contraindications and hazards that Bohler[10] opposes massage and passive movements.

Summary

Massage is an important adjunct in the treatment of fractures. It can be used however only when one understands the nature of the healing process, the manner in which massage may favorably influence the healing process, the definite contraindications to its use, and the grave dangers incurred by abuse. A simple classification of massage divides it into:

(a) stroking, superficial or deep;
(b) compression, which consists of kneading, friction and petrissage;
(c) percussion (or tapotement), "beating" the tissues;
(d) vibration, "shaking" the tissues.

The application of these various types of massage depends on definite general principles and on the particular problems of specific fractures. The most important consideration in the treatment of fractures is perfect apposition of fragments, adequate immobilization, massage and passive and active motion, so as to give the maximum return of function in the minimum of time.

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Discussion

Dr. Markley C. Cameron (Los Angeles): At the risk of repetition I would like to stress a few points that Dr. Levine has brought up. First, that massage should be used as early as possible without losing sight of the fact that ultimately we are trying for solid union. Hence we should apply massage to every individual case, as is seen fit. I want to sound a word of warning against the use of any set schedule of time limit placed upon the use of massage in the treatment of fractures. To repeat, each case is different and should be treated individualistically.

A recent article in the ARCHIVES OF PHYSICAL THERAPY stated that an attempt is being made to teach the idea that massage should be started before reduction and carried on through the course of treatment. I disagree with this for two reasons. The first is that certain other conditions preclude or take place over massage so early in the treatment. One of these is surgical shock which takes precedence whenever it is seen. Another is that often the jagged bone ends are impinging on both blood vessels and nerves and only immediate accurate reduction can alleviate this complication.

I would like to mention one type of massage that Dr. Levine left out, but only to condemn it. That is too heavy or too deep massage. This is best illustrated in the case of a man who sustained a fracture of the right femur. After adequate treatment he was crossing the ocean, slipped while on board and refractured the femur. After landing in France and again after adequate treatment, a technician decided one day to give him deep and heavy massage. This was done and much to his dismay the femur was fractured once more in the same place.

I want to ask Dr. Levine one question, because most of the discussion has centered around the early use of massage. I should like to know when its use is late in the treatment of fractures, specifically as it pertains to so-called delayed union.

Dr. Max A. Levine (closing): In delayed union we are dealing with a poor or deprived circulatory area at the fractured site, and anything done to increase vascularity such as massage would have a beneficial effect and promote healing.

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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EDITORIALS

D'ARSONVAL AND THE NOBEL PRIZE

It is with due respect for the eminent men constituting the Nobel Prize Committee, but also with the firm conviction of presenting a good and just cause that the American Congress of Physical Therapy ventures to issue the following appeal. Fully cognizant of the great honor associated with the award of the Nobel Prize, appreciative also of the fact that the coveted honor has been bestowed impartially and solely for outstanding services rendered humanity, realizing furthermore that such services have been weighed with great care, we feel convinced that this appeal will not go unheeded, but will be considered on the basis of merit.

We most respectfully and most earnestly submit for the consideration of the Royal Nobel Prize Committee the name of *Professor Arsène d'Arsonval,* of the Collège de France, as a most worthy beneficiary on account of his outstanding contributions to the science of medicine, and more specifically to electrophysiology and electrotherapy.

Arsène d'Arsonval is one of the most illustrious savants of France. But while that great Republic claims him as a native son, he is hailed as a citizen of the world of science. In every civilized land of our globe Arsène d'Arsonval is recognized and appreciated as a scientist of profound erudition and above all as one of the greatest benefactors of the present generation. In the special field that was the ground of his ingenious research and epochal discoveries, he stands in a class by himself. Others have followed the paths he has pointed out and have even developed in a technical sense his ideas, but whatever successes they have attained are due primarily to his genius.

We most respectfully submit that when after years of painstaking, intricate and original research, d'Arsonval, towards the end of the past century, gave the medical world his discovery of the physiologic properties of the high frequency

current, he not only opened a new field in therapy but laid the foundation for a method that has proved of inestimable value also to modern surgery.

Other eminent men who in the past have made valuable contributions in the field of physical therapy, particularly in light, radium and x-ray therapy, have been honored by the award of the Nobel Prize. Taking this as a criterion, we feel that a discovery which has brought about the amelioration and cure of many diseases that had proved refractory to all known methods of therapy before d'Arsonval's discovery, is entitled to at least equal recognition.

D'Arsonval's studies and discoveries have provided physicians in all lands with weapons effectively to combat many inflammatory affections. Diathermy and its later development as ultrashort wave radiation have enabled the medical world to combat even the severe types of arthritis and similar conditions. Inflammatory processes in almost every part of the human body can now be relieved speedily and without the necessity of having recourse to pain-relieving drugs. Many pyogenic infections have been aborted or at least shortened in their course. Again countless sufferers from the effects of trauma sustained during the Great War have escaped the inevitable disabilities and were enabled to resume their accustomed occupations.

Electropyrexia, made possible by d'Arsonval's discoveries, has not only saved many paretics from being a useless burden on communities but has enabled them to reenter human society as useful members. The same method has already rid many sufferers of specific infections and crippling diseases. What is of great importance is the fact that we have here a means of administering controllable thermotherapy.

A modified type of high frequency current has been used by numerous surgeons of the highest standing to extirpate malignant growths without the risk of producing metastases by inoculation. One need only think of the many lives saved by transurethral resection to appreciate the tremendous value of surgery by the high frequency current. By this method many who would have succumbed from operative shock have borne their ordeal with lessened hazard and have enjoyed a convalescence devoid of postoperative pain.

Organized medicine, after having carefully weighed the accumulated evidence, has put upon the methods above enumerated its stamp of approval as the most valuable and conservative additions to the medical and surgical armamentaria.

When a great engineer succeeds in harnessing some tremendous natural force to provide power to industry, he is hailed as a benefactor. D'Arsonval, by his creative genius, has harnessed an electric force ordinarily capable of destroying animate life, to bring surcease and cures to thousands upon thousands of sick humans. And we feel that for this achievement, to which the great savant had dedicated his life, he should not be overlooked at the next conclave by those who have the power to reward great merit, and we earnestly ask that they bestow on him the Prize in the spirit of the will of its immortal founder — Alfred Nobel.

IONIZATION IN DISEASES OF THE EYE

Ionization is a procedure that has been introduced in medicine many years ago. For a long time it failed of general appreciation by the profession until more recent experimental and clinical labors aroused a widespread interest in its therapeutic indications. The results obtained in arthritis from ionization with histamin, introduced by Deutsch[1] in Europe, and Kling[2] in America, with mecholyl introduced by Joseph Kovács,[3] as well as those with zinc and other

metallic solutions in certain affections of the nose and ear, have demonstrated its value as a therapeutic adjuvant, especially when applied to mucous membranes.

The most recent contributions to the literature deal with the favorable effect obtained in a comparatively large number of diseases of the eye and of the conjunctiva. While this addition to the ophthalmic armamentarium is of particular interest to specialists, the technic of ionization in ophthalmology varies so little from that utilized to treat other mucous membranes that there is no reason why practitioners interested in physical therapy should fail in adding this type of work to their daily routine.

So far as the method proper is concerned, one needs only a weak galvanic current for comparatively short applications. As in other forms of ionization, here too one uses a dispersive and an active electrode which can be easily manufactured to satisfy one's wishes, the principle being a small holder of a pledget of cotton wool attached to an insulated thin wire that carries the current from the battery or apparatus to the pledget, which for therapeutic use is thoroughly moistened with whatever solution one may select. In general one-half to two milliamperes is all the intensity needed for the treatment of the eye proper, and a seance not to exceed ten minutes will prove adequate for deep ulcerations. Inflammatory processes require much less in time.

Of the groups of cases that have been successfully treated by ionization are those which in certain instances can be diagnosed and managed by even non-specialists. The most common type is conjunctivitis. In the acute stage a solution of zinc sulphate, one-quarter of one per cent in strength, proved effective. The treatment is followed by no undue reaction. For conjunctivitis seen in the chronic stage, Erlanger[1] and others recommend the addition of half of one per cent of calcium chloride to the zinc solution. Follicular conjunctivitis responds well to ionization of a solution containing solely calcium chloride in the strength of one-half of one per cent. The milliamperage and time of exposure remain unchanged.

Striking results have been obtained in various types of catarrhal ulcers of the cornea. Each ulcer must be treated separately with a weak solution of zinc sulphate to which a minute quantity of adrenalin has been added. Equally good results have been obtained in serpiginous ulcer of the cornea. One must recall that in this type of ulceration, an ulcer in one place may heal while another appears some place distant from the healed one. For this comparatively rare condition a solution of optochin, 1:600, applied with the same technic, has proved even more effective than solutions of zinc and quinin in combination. According to Erlanger, whose data are supported by other authorities, the scars following ionization are much more transparent than those obtained by classic methods.

Of the several types of keratitis even the gravest form characterized by opacities quickly responds to zinc ionization with complete restoration to normal. It is surprising that ophthalmologists have waited so long before adopting ionization for this condition, because Erlanger, as early as in 1922, published a report which showed that he had obtained cures within three weeks. When one takes into consideration that no less an authority than Fuchs has taught that this disease runs a very protracted course under classic management, it would seem that the profession should have made an earnest effort to confirm or deny Erlanger's claim, but ionization is no exception in the life-histories of many other valuable therapeutic remedies or measures.

The extensive use of atropin in ophthalmic practice promises to be replaced by its ionization in cases of iritis. A solution, 1:1000 with a current of one and one-half milliamperes administered for two minutes daily, has caused abatement of the acute symptoms in a short time, when treatments need not be given oftener than every other day. Finally in all cases in which it is desirable to

enhance ocular circulation, ionization of substances like histamin, eserin, acetyl cholin and others have proved of considerable value.

The uniformity of successes reported by authoritative specialists clearly shows that ionization merits thorough study and application in a field that undoubtedly will be greatly enlarged as its rationale is being appreciated by both specialists and general practitioners.

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The Editor, the Editorial Board and the Officers of the Congress extend

Season's Greetings

and sincerely wish the fellows of the Congress and the subscribers to the Archives

A Merry Christmas

and a

Very Happy New Year

Correspondence

Re: Temperature Effect of Short Wave Diathermy

To the Editor: — Referring to the highly meritorius paper by John S. Coulter and Stafford L. Osborne which was published in your November issue under the title of "Short Wave Diathermy in Heating of Human Tissues," I am constrained to solicit for more detailed information on several points of this contribution because it is the impression that the conclusions of the authors do not appear to be in harmony with their facts.

In the charts on page 682, regarding coil technic (electromagnetic field) it was shown conclusively that it is immaterial whether one wavelength or another is used to produce temperature rises in muscle and subcutaneous tissues, the final temperature rises being the same irrespective of the wavelength. Can they let me know whether or not it was necessary to change the number of ampere turns used with the various machines or did they use the same number of ampere turns irrespective of the wavelength? Is the number of turns around the thigh of importance or is the current going through the coil the important factor, or will any combination of a number of turns times current give you this same heating? Did they take into consideration the distributive capacity effect of the turns used around the thigh?

In the chart showing the use of the cuff technic (electric field) it seems to me that these charts showed definitely that a uniform temperature rise is attained when using the six meter machine; also that the longer the wavelength of the unit, the further the discrepancy in temperature rise between the subcutaneous and muscular tissues. This would be far different than the conclusions drawn on page 687, in which it is stated that there are no significant differences in the use of any wavelength when using the cuff technic.

In explanation of figures 1, 2, 3, 6 and 7, it is shown conclusively that the temperature rise of the muscle is far greater for the six meter machine than for the nine meter machine but the following statement is made on page 682: "However, *in the opinion of the authors*, this difference can not be attributed to the wavelength." Since they have used tolerance as their guide in all these tests, I would like to know what other conclusion they may have come to because the conclusions on page 687 do not seem to take care of this factor.

Have they tried using the air-spaced electrodes directly above and below the point of insertion of the thermocouples? I am wondering whether one would record higher temperatures with the electrodes directly above and below the thermocouples as it seems to me the energy would then be passing directly through the area on wanted heated, whereas when one uses the teral plate technic the energy may never pass through the region wherein you have inserted the thermocouples. This refers to the technic as outlined in figures 3, 4 and 5 on pages 684 and 685.

If uniform temperature rises in the subcutaneous and muscle tissue are of importance therapeutically, I feel that they have proved conclusively that when using the cuff technic one could produce more uniform temperature rises with a six meter machine than with any other wavelength above six meters.

Very truly yours,

NORMAN E. TITUS.

Reply to Dr. Titus

To the Editor: — We are indeed pleased to have the opportunity to discuss the open letter of Dr. Norman E. Titus, and submit our replies to his questions in the order given by him.

1. Four turns of coil were used in application for each wavelength. The value of the electrical concept, known as ampere-turns, was not determined. An attempt was made to measure the current flowing in the coil, but the readings obtained could not be relied upon, because the ammeters were not a true indication of a current at all frequencies. The high frequency meter (thermocouple type) may have been accurate at one or more frequencies, but the instrument makers would not give us assurances that they are accurate for all the frequencies we used.

The technic of application was the same in all observations. Four turns were spaced as evenly as possible and the same thickness of felt or toweling between the coil and the skin was used in all cases. As stated, skin tolerance was used as the control for the current strength. We believe that the distributive capacitative effect between the turns is important, but we made no attempt to segregate the capacitative effect from any other effect.

2. If one plots the value of the final temperature in the muscle tissue against the wavelength, there appears to be on first glance a better heating effect with the six meter one. There is a temptation to let wishful thinking take charge of the conclusion that the shorter the wavelength the greater the internal heating.

As indicated in the "Discussion," page 686, we are not sure of the accuracy of the readings to within plus or minus one-half degree Fahrenheit. The aggregate of the errors might be all plus in one instance and all minus in another. For example, suppose muscle final temperature of the twenty-four meter reading is one-half degree low and that for the six meter is that much high. One is tempted to say that the twelve meter current would be most effective, but since the same error is subject to the twelve meter result as it is to the others, one should not draw such a conclusion. We believe that an attempt to prove that the six meter or the twelve meter wavelength is more efficacious than the fif-

teen, eighteen, or twenty-four meter, would be to base the conclusion on data, the error of observation of which would be as great as the effect that is to be proved. In our opinion, the evidence is not conclusive; hence, we preferred to say: "There are no significant differences between the heating of live human muscle or fat with different wavelengths."

3. It seems to us that paragraph two of the Conclusions, page 687, is adequate to account for the difference. One important point to observe is that the electrode for the nine meter machine was four inches, while that for the six meter machine was five inches in diameter.

We have tried using the air-spaced electrodes directly over the point of insertion of the thermocouple, but abandoned this method because of many technical difficulties. Essentially, we may say that the gradient, high to low temperature, is skin, subcutaneous tissue, and muscle. In other words, it is warmer directly under the electrodes than at any other point.

Dr. Titus has mentioned several problems which might be made subject for further investigation.

Respectfully submitted,

JOHN S. COULTER,
STAFFORD L. OSBORNE.

Concerning "Iontophoresis In Rheumatoid Arthritis"

To the Editor: — Dr. Phillips in his recent article, "Iontophoresis in Rheumatoid Arthritis" reports therapeutic results with mecholyl in rheumatoid arthritis which offer a "marked contrast" to my findings as stated in "Iontophoresis of Acetyl-Beta-Methylcholin Chlorid in the Treatment of Chronic Arthritis and Peripheral Vascular Diseases, a preliminary report," published in the *American Journal of the Medical Sciences*, July, 1934. I wish to make three comments regarding this paper.

1. Since the preliminary report two other studies have been published by my associates and myself — the latest in January, 1936 (*American Heart Journal*) — on the same subject, wherein we re-evaluated our original results on the basis of further intensive and follow-up observations. I am surprised to note that Dr. Phillips neglected to mention the more recent reports, or perhaps he was entirely unaware of their existence.

2. Dr. Phillips bases his conclusions upon results obtained from a very small number of treatments. Save in the cases of his first two patients, he averaged only 4.8 treatments per patient. It is reasonable to point out that when confronted with a chronic disease as arthritis, one can not expect conclusive result in such a very short time. Nine of the author's cases received four treatments or five. He drew conclusions from three cases after two treatments. What form of therapy gives uniformly remarkable results in chronic arthritis after two treatments? Every new form of treatment deserves a fair trial before negative conclusions are drawn. It is significant that in the first two cases where a more or less extended treatment period was instituted, patient No. 1 experienced temporarily less pain and stiffness after eighteen treatments, while patient No. 2, after seventeen treatments, showed definite improvement. Both cases were originally severe.

3. In contrast to Dr. Phillip's experience (which, in all justice, he declares to be "not extensive") we believe that the tecinic of treatment is very simple; in fact, mecholyl iontophoresis may be administered at the patient's home without difficulty, requiring no cumbersome equipment, such as the Hubbard tank, but by contrast only a single galvanic apparatus.

If Dr. Phillips will take the trouble to refer to our article in the *American Heart Journal* on the Choline derivatives, he will find that we express the conclusion that mecholyl iontophoresis, like all forms of physical therapy, constitutes a palliative method which is of value in certain cases when other types of therapy fail.

JOSEPH KOVÁCS.

Erratum

The article by Coulter and Osborne in the preceding issue contains erroneous legends on page 682, which should read:

Chart 1. — Relationship of wavelengths to heating for cuff application. Subcutaneous readings do not represent the temperatures under the electrodes.

Chart 2. — Relationship of wavelength to heating for coil application. Subcutaneous temperatures do not represent the temperatures directly under the coils.

Pacific Physical Therapy Association Meeting

The regular November meeting of the Pacific Physical Therapy Association was held November 25 at the Holiy Hospital at which time a program was presented as follows:

1. "Electro-Diagnosis in Neurology," by Samuel D. Ingham, M.D.
2. "The Medical Speakers Bureau," by Rolph M. Yombert, M.D.
3. "Experimental Study of Pathology and Repair of Muscles," by George G. Berg, M.D.

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INVISIBLE RADIATIONS OF ORGANISMS. By *Otto Rahn*, Professor of Bacteriology, Cornell University. With an Introduction to the Physics of Radiation by *Sidney W. Barnes*, Research Associate in Physics, University of Rochester. Cloth. Pp. 215 with 52 illustrations. R. M. 13.20. Berlin: Verlag von Gebrüder Borntraeger, 1936.

This is the ninth volume of the *Protoplasma-Monographien* series released under the auspices of an international group of publishers for the dissemination of special scientific knowledge, in the English, French or German language. That it is a most worthy undertaking goes without saying, because it universalizes certain important information which otherwise would indefinitely have remained hidden from those capable of correlating it with their own particular problem. As indicated by the above title, this work deals with one of the newest and most intriguing problems related to biologic, medical and agricultural pursuits. Although emission of invisible radiation in living organisms is comparatively a recent discovery in science, the information at hand has already indicated that a certain type of intracellular activity is present in the form of measurable radiation and this in direct relation to intrinsic and extrinsic influences upon the organism. It is pointed out that the individual cell and even the whole organism is subject to the stress of radiation not always identical with mitogenic radiations; namely, the *beta*-radiation of the potassium in the cell; the *necrobiotic* radiation of the dying cell; the harmful (menotoxins) radiations emitted by females, infections and salivary excreta. Within the frame of seven chapters, which includes a comprehensive bibliography and a detailed summary of the objective and characteristics of invisible, minute radiations on the function and activity of biologic processes, the author reviews and interprets the physics and the sources of radiant energy; the effect of ultraviolet radiation on the cell; methods for observing biologic radiation and the analysis of mitogenetic effects. It is interesting to note that the work of Gurwitsch on the presence of minute radiation in mitogenetic processes has received substantial confirmation and that these rays are now shown to play an important role not only in bacteria and in the seedlings and roots of higher plants, but also in the tissues and circulating fluid of the higher animals. Of special interest to the physician is the demonstration that wounds while healing, radiate, and that the healing process can be accelerated by mitogenetic irradiation. Perhaps diagnostic medicine will make much of the fact that cancer tissues radiate strongly, while the blood of such individuals radiate weakly, a phenomenon directly opposite to that found in normal individuals. One closes this compact and stimulating work with a conviction that Rahn has clearly pointed out a new path in the progress of science, one that contains many promises for the greater good of mankind.

INFANTILE PARALYSIS. By *George Draper*, M.D., Associate Professor of Clinical Medicine, College of Physicians and Surgeons, Columbia University. Cloth. Pp. 167 with illustrations and charts. Price $2.00. New York and London: D. Appleton-Century Company, 1935.

The fact that infantile paralysis is popularly conceived a disease of childhood and that it leaves in its wake an army of hopelessly crippled is responsible for the sympathetic interest and poignant fear and horror of the lay world, and the striving of the medical world to conquer this problem. Poliomyelitis is today a challenge to the world of science, and its eradication the desideratum of both the clinician and research worker. Draper has presented in fluent rhetorical strokes a conservative, coherent, stimulating and philosophical exposition that reviews the antiquity of the problem; the susceptibility of the individual; the portal of microbic invasion; the factor of human resistance; the nature of the virus and its epidemic tendency; the bedside picture and the variables encountered; the outlook in terms of what the medical profession possesses in the nature of therapeutic ammunition for the prevention, cure and control of complications. One feels that this book is an impressive and long to be remembered contribution, because the author has managed to include the salient facts, opinions and theories on this problem in a manner that holds the interest of the reader from beginning to end. Indeed, the author's talent for crystal clear exposition, his wide experience in this field as well as his progressive opinions and published works in related medical subjects, gives to any of his literary efforts an assurance of authoritative background and a guarantee that it will be interestingly presented. This book is heartily recommended to the medical and nursing professions, and to the intelligent reader.

ENERGY AND MATTER. Building Blocks of the Universe. By *Charles B. Bazzoni*, Ph.D., Professor of Experimental Physics, University of Pennsylvania. Cloth. Pp. 137 with over 40 illustrations. Price, $1.00. New York: The University Society, 1934.

The profession has long realized that many of the physical agents utilized for clinical purposes are fundamentally energy emitting instruments in the form of radiation or conveyors of electric currents which in turn provoke physiologic effects upon living tissue. The difficulty heretofore has been to correlate the nature of the energy and to interpret the constitutional nature of matter and its constituent parts for the benefit of those who are daily making use

of these forces for therapeutic purposes. No other branch of science has been more fruitful in promoting this orientation than that of physics, and in no other period of the history of medicine has there been a greater appreciation of the debt to and the relationship of physics to therapeutics than is observed in the present era. Unfortunately the newer physics has been enveloped in an impenetrable mathematical formulation that only the chosen few could appreciate. Need for bridging this difficulty has fully been recognized and attempted, but no one has come so close to bringing new understanding and lucidity as to the nature of the "building blocks of the universe" than Bazzoni. It will be recalled that several years ago his story of the *Kernels of the Universe* was perhaps the most outstanding nontechnical contribution of the constitution of the material universe published in English. It formed part of the text of many instructors of scientific physical therapy. The work under consideration contains the same desirable qualities, but in addition is more down to date. Newer experiments have given us increasing experience as to the nature of energy and matter and have provided a clearer interpretation of their utilitarianism in therapy. The present volume discusses in the space of nine chapters the drama of man in search of ultimate physical truths in nature. This search reviews the ancient and modern interpretation of the structure of matter; the nature of energy; the atomic theory of past and present conception; the facts about electricity and electrons; our understanding of absorption and emission of radiation, and the interconversion of energy and matter. The author is to be congratulated on his special talent of clarifying such an abstruse subject and of infusing into his exposition such a warmth of interest as to render its reading an absorbing adventure in search for cosmic truths. The work contains a list of suggested books for further reading, a glossary and an index. This small book is enthusiastically recommended to instructors and students of physical medicine.

GET IT RIGHT. A Cyclopedia of Correct English Usage. By *John B. Opdycke*. Cloth. Pp. 673. Price, $3.50. New York and London: Funk & Wagnalls Company, 1935.

It is frequently pointed out that creative literary efforts are fraught with difficulty and discouragement or with greatest mental exhileration. The mechanics or instrumentation of writing requires not only the fixation and clarification of the captured idea within our own memory, but the rhetorical facility of transposing the thought to the written word in a style as to render it as comprehensive to the reader as it is to the writer. The art of writing depends upon study, practice and adherence to the trinity in rhetoric, called grammar, usage and words. These and other guides to expressional emergencies are found in this first-aid kit to literary effort. This book is a veritable omnibus of information that can be consulated whenever decisions have to be made between exact and precise speech, between bad, indifferent and questionable expressions. It is a work while not pretending to be complete nor infallible in the sense of a universal encyclopedia on the subject, is nevertheless a contribution rich and useful in content as to make it a valuable reference guide to those in need of a concise "get it right" manual that will help to differentiate the right from wrong in grammar, punctuation, spelling, word study, and the like. No one can fully appreciate the value of such a book until he is in the groping midst of creative literary effort, and only then will he realize the rich storehouse of information at his disposal.

INTERNATIONAL ABSTRACTS

On Scientific and Practical Value of Ionization in Ophthalmology. Gustav Erlanger.

Brit. J. Ophthal. **20**:213 (April) 1936.

Ionization about the eye can be successfully performed with a low cost apparatus that makes use of dry cell pocket batteries, a milliampere meter in the circuit and a socket and switch. The intensity of current is very low, the deviation very short and the technic is simplicity itself. Two fine wires are connected to each of the poles, one attached o a hand electrode the other to a capsule which contains a piece of cotton wool which is soaked with the desirable medicament — zinc sulphate 0.25, or calcium chloride 0.5 per cent, optochin, histamin, acetylcholin, and similar drugs. Erlanger reviews the effect of many well known preparations by means of ionization and calls attention to the striking results obtained and these without traumatization of the delicate structures and without the usual scarification. Ionization can be used in conjunctivitis, catarrhal ulcers of the cornea (serpigenous and other types), the rare keratitis disciformis which can be wholly cured in a very short time, trachomatous conjunctivitis, episcleritis and sceleritis, tuberculous keratitis, iritis, the choroid, retina and even the optic nerve. In the latter conditions, ionization exerts a vasodilating action due to the drugs (histamin, acetylcholin, doryl, dionin) producing an urticariogenic effect.

Phosphatase Content of Human Serum in Pulmonary Tuberculosis Following Administration of Vitamin D. Paul D. Crimm, and J. W. S. Strayer.

Ann. Inst. Med. **9**:1393 (April) 1936.

The phosphatase content of a normal human serum was found to average 3.31 units in a series of 19 cases. In 32 cases of pulmonary tuberculosis, all stages, the phosphatase content averaged 2.95 units. Administration of viosterol, 10,000 X, in dosage resulting in hypercalcemia, caused a slight reduction of serum phosphatase in blood serum. Fourteen cases of pulmonary tuberculosis showed a decrease while ten showed an increase. Seven of the eleven whose serum calcium was 14.0 mg. or over showed a decrease in serum phosphatase content.

Results Obtained by Use of Fever Therapy. M. Hill Metz.

J. A. M. A. **106**:1658 (May 9) 1936.

The striking results obtained by fever therapy in cases of Sydenham's chorea, and a severe case of status asthmaticus, deserves serious consideration. Six young females with Sydenham's chorea were treated by the Kettering Hypertherm. Because of the difficulty in feeding, of vomiting and of excessive movements, all were very poorly nourished. All were given from three to five treatments at weekly intervals, each treatment consisting of from three to four hours, with temperature between 106 and 107 degrees F. Shortly after the first treatment in each case there were fewer choreiform movements, and the patients rested with fewer sedatives. Improvement was slow but definite, and in from two to four weeks after the last treatment all involuntary movements had disappeared and the patients ate and slept normally. In only two cases was there the suggestion of choreiform movements under the stress of excitement. These cases have been followed for from two to eight months, and there has been no recurrence of symptoms in any.

Eight cases of intractable bronchial asthma were treated with fever therapy. All were of the most severe type, having presented this disease for from two to twenty years. Multiple sensitivities to bacteria, foods and pollens were present in each case. All patients had had severe attacks of status asthmaticus at repeated intervals, oxygen therapy having to be administered. The relief offered has been complete in three cases, lasting from two to six months. This type of therapy is not recommended as effecting consistent cure or even as a means of alleviating all bronchial asthma, but it is worth trying in severe asthmatic cases that respond to no other form of therapy.

Electrical Anesthesia: Simple Curative and Symptomatic Treatment of Painful Dysphagia in Tuberculous Laryngitis. R. Grain.

Tubercle **17**:261 (March) 1936.

Laryngeal tuberculosis may be painless, but when pain is present it may give rise to painful dysphagia which demands relief. Because previously introduced methods such as alcohol injection and direct cauterization have not been uniformly successful, or have been too traumatizing, the author attempted local anesthesia by iontophoresis. Stainless steel electrodes were fashioned to fit the curvature of the neck. The anterior one is 7.5 by 3.5 cms. and is placed in front of the laryngeal region; the posterior, is 10 by 3.5 cms. and placed over the nape of the neck. Between the electrodes and the skin are strips of absorbent cotton, one centimeter thick, impregnated with a 2 per cent solution of potassium iodide. The electrodes are maintained in position by a rubber collar. Treatments are given daily for 30 minutes at 10 to 12 ma. and 45 volts. At first the anesthesia will only last for a short period, but after about eight treatments it will last 24 hours. The author found that this

anesthetic period was doubled after each treatment. At the onset there is an initial sensation of stricture, followed in about five minutes by anesthesia, ptyalism and a metallic taste. The results are not influenced by fever, the general or local condition; and excellent results were noted in 98 per cent of the cases. This is a symptomatic treatment which has no effect on the progression of the tuberculous lesion.

Physical Therapy of Furunculosis. J. Meyer.

Ann. Inst. d'actinol. 11:191 (June) 1936.

The author offers indications, dosage and comparative values of roentgen, short wave and ultraviolet therapy in furunculosis. Since nearly all furuncles are self-limited and the average practitioner will exhaust the list of chemical and biologic preparations before employing physical agents, the physical therapist is usually consulted in the more stubborn cases. In chronic or regional furunculosis, ultraviolet light was found superior to short wave and roentgen therapy. X-rays were given in doses of 50 r. for 20 days up to a total of 300 r., through 3-5 mms. of aluminum. Seven cases were relieved, but the eighth was a total failure. Of 22 patients exposed to ultraviolet radiation alone, all were well within a month. Of these, seven had recurrences within two to three months, which were relieved by further exposures. General ultraviolet radiation, first recommended by Humphris in this condition, was employed as an adjuvant to local therapy with great success. The author stresses the importance of using a carbon arc for this purpose, rather than mercury quartz, because the latter does not emit the longer beneficial rays. In the local application he uses an initial erythema dose, and increases it as much as 50 per cent at each visit, on alternate days. Further eruptions are often seen during the course of the treatment, but these too, are usually gone before a month of radiation. In obstinate cases, only the radical epilation by x-ray will be effective, but this method is not advised.

The isolated furuncle is considered in three groups, of which the anthrax group is not treated by physical agents because of the possible deleterious effects. The other two embody the dangerous, which is seen in the midfacial or lip region, and the painful which appear on the neck, nose and perineum. In the dangerous or lip group, 50 patients were treated by x-radiation without a failure or mishap. A single dose of 100-200 r. at 100KV was given to the area and its periphery through an aluminum filter of 1-5 mms. Occasionally a second dose was given on the third day. After 36 hours the fever is reduced and the pus begins to flow. In most cases there is a slight increase in pain, which lasts a day. In all cases there is a demarcation of the inflammation, but occasionally, the pus has to be evacuated by surgical measures. In the same type of cases, short wave was employed, but did not seem to alter the clinical course of the disease, although it did relieve the pain rapidly in most. When the furuncle has gone on to necrosis, actinocautery, or carbon-arc light concentrated by passage through a quartz lens is directed at the diseased area which causes an extrusion of the core and free drainage of pus within 24 hours.

Pathologic Changes Resulting From Accurately Controlled Artificial Fever. F. W. Hartman, and R. C. Major.

Am. J. Clin. Pathol. 5:392 (Sept.) 1935.

The study of Hartman and Major on the pathologic changes resulting from artificial fever therapy consists of two clinical cases coming to necropsy after fever therapy and of twenty dogs, eighteen of which were subjected to fever of various durations and degrees and two of which were used as controls, being given excessive amounts of sodium amytal, a sedative used in all but two of the other experiments and in the human cases. They found that the pathologic changes in the human cases and the experimental animals were engorgement of the blood vessels, especially the capillaries, hemorrhage and degeneration. The most vital changes seen were those in the brain, amounting to hemorrhagic encephalitis in some instances, those in the lung constituting hemorrhagic pneumonia and those in the adrenal characterized by degeneration in the cortex with hemorrhage. Death occurring during or immediately after treatment was due to vascular collapse. Although the changes described have been noted in animals receiving morphine alone as a sedative, the human patients and most of the animals received sodium amytal, a drug which in large amounts is known to produce congestion and even capillary damage, especially in the brain. Since fever therapy and sodium amytal tend to produce marked dilatation and engorgement of blood vessels, the authors suggest that the combination should not be used on patients. — J. A. M. A. 105:1636 (Nov. 16) 1935.

Treatment, Other Than Operative, of Nasal Accessory Sinuses. William Mithoefer.

Ann. Otol., Rhin. & Laryng. 45:420 (June) 1936.

Infra-red therapy is a valuable adjunct in many cases of subacute nasal sinusitis. Especially is this true in patients affected with subacute ethmoiditis. An exposure lasting from forty-five minutes to one hour is necessary if good results are to be obtained. Supplementing this therapy is the use of Bier's hyperemia. An elastic band about an inch wide is applied about the neck immediately above the clavicle and allowed to remain three hours. It must be adjusted sufficiently tight so that a sense of fullness in the head is experienced, and should be applied again one hour after its removal. The passive hyperemia thus established accounts for its beneficial action. Its use is contraindicated in the presence of vascular hypertension and in all in whom pus is retained under pressure. Ultraviolet radiation is also of benefit in some cases.

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Official Journal American Congress of Physical Therapy

16th Annual Session
AMERICAN CONGRESS OF PHYSICAL THERAPY
SEPTEMBER 20, 21, 22, 23, 24, 1937
NETHERLAND PLAZA CINCINNATI, OHIO

Volume XVII DECEMBER, 1936 No. 12

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